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OF THE

CEMENT AND ENGINEERING NEWS

Vol. 28 TRANSPORTATION BUILDING, CHICAGO, JANUARY, 1916 No. 1

ENGINEERING

Specialists in Designing and Equipping

CEMENT WORKS

We investigate, chemically and physically the raw materials, and furnish reports, detail estimates, complete plans and specifications, embodying the best modern practice. We have had thirty-one years experience in building and reconstructing cement plants the world over.

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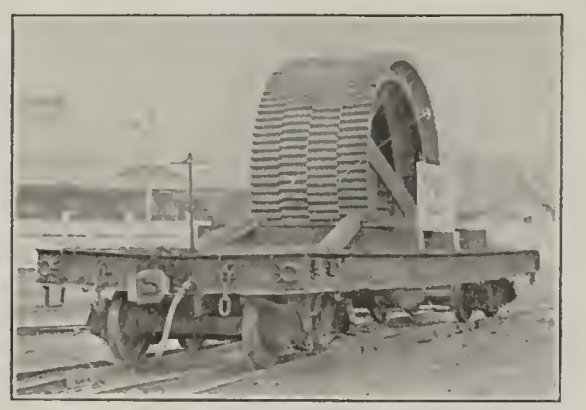
F. L. SMIDTH & COMPANY

ENGINEERS

50 CHURCH STREET, NEW YORK.

Stroh Process



First shipment of gears for Universal-Portland Cement Company's plant of Duluth which is being equipped with Stroh Process Gears and Pinions.

Pinions and Gears
Grinding Plates
Crushing Plates
Track Wheels
Sprockets
Sheaves
Liners
Mantles
Concaves

WEAR-PROOF - LOW PRICED

Fracture of Involute Tooth

Trade Mark Registered

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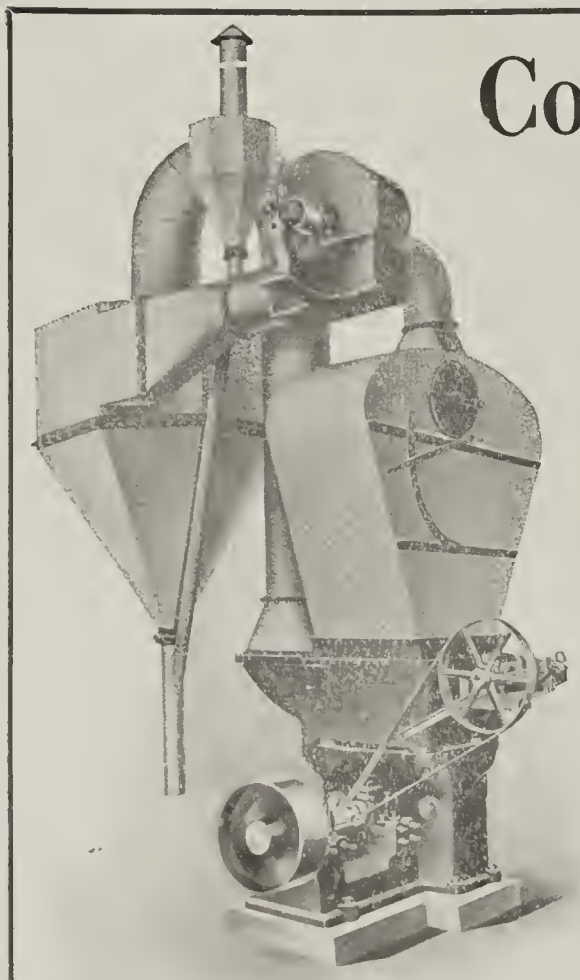
Kennedy-Stroh Corp.

PITTSBURGH, PA.



Complete Grinding

IN ONE

MACHINE

In successful use grinding Cement, Clinker, Limestone, Coal

INSTANT REGULATION OF FINENESS

NO DUST

Send for circular

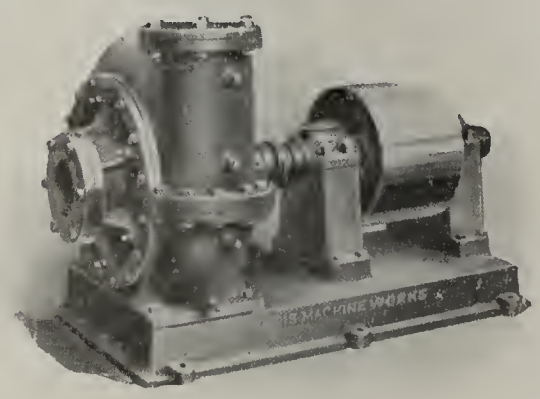
THE BONNOT CO.

CANTON, OHIO

MORRIS

Solid Lined

Dredging Pumps



EVERYTHING that enters into the construction of the Morris Solid Lined Dredging Pump is of heavy proportions and the general design is such that wear is reduced to the smallest possible extent. Its ability to outlast other dredging pumps is its chief claim to economy.

By removing the upper half of the pump shell, the lining can be taken out or by removing the disc on the pump shell and the inner disc on the lining, the runner can be taken out. The pump is easily and quickly taken apart if necessary to replace lining or piston.

Write for Sand and Gravel Pump Catalog

Morris Machine Works

Baldwinsville, N. Y.

NEW YORK OFFICE, 39 Cortlandt Street

HENION & HUBBELL, General Agts.
227 No. Jefferson St., Chicago

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*Affleck Becomes Chosen Cement Leader**

Annual production of Portland cement in this country has reached the enormous dimensions of sixteen million tons, in fact if every one of the mills were to be operated every possible day, present manufacturing capacity would show a shade more than twenty million tons. Yet it is one of the younger industries, for more than three-quarters of the present outputs have come into bearing during the last fifteen years.

As the industry has grown so have the men grown who have been identified with its unprecedented expansion and progress. At first the men, of course, had to be drawn from other industries and activities, the leader of every cement organization being a man who had previously achieved success and eminence in some other line. The very commercial and financial importance of such an organization calls for big

B. F. AFFLECK.

President, Cement Products Exhibition Co.; President, Association of American Portland Cement Manufacturers; President, Universal Portland Cement Co.

men to attract confidence, so the presidents of cement companies have all been big men. Their composite measure cannot be excelled in any other industry, but without exception they have been giants of industry before entering the wonderful arena of cement activity. All of this is true because cement is such a comparatively new product.

With the election of B. F. Affleck, president of the Universal Portland Cement Co., to be president of the Association of American Portland Cement Manufacturers, that body for the first time has chosen a man whose achievements and present eminence is a part of the cement industry itself. The first simonpure specimen and product of cement to reach the highest office of confidence and esteem in the national organization of cement manufacturers.

The very high honor has been well placed, for Mr. Affleck is big enough in all kinds of dimensions to fill all possible requirements. Full six foot two, he is every inch a salesman. First, gifted by nature with the versatile talent that makes salesmanship a possibility, he has studied and worked persistently for years and knows for himself all of the main roads and byways that lead on to the sales of cement.

Mr. Affleck is a western man, born in the historic little city of Belleville, Ill., about 45 years ago. There he grew to manhood, and as a boy was attracted to the only industry at hand and became a machinist before he attained his majority. When twenty years of age the call of his genius led him to seek salesmanship as a calling, so he went to the nearest big city, St. Louis.

Just twenty years ago he entered the employ of the Illinois Steel Co. as salesman at its St. Louis office. He already knew a good deal about steel in a practical way, and soon learned how to sell it, and who to sell it to, and so made good.

With the organization of the United States Steel Corporation in 1903, the cement department of the Illinois Steel Co. became the Universal Portland Cement Co., under Mr. Hagar, and B. F. Affleck came to Chicago as the chief, first, and only salesman. The output of the Chicago mill at that time was 400,000 barrels per annum. Then the steady and rapid growth to 12,000,000 barrels capacity was only a matter of persistent attention.

About one year ago Mr. Affleck was elected president of the company he has served so well for twelve years, upon the retirement of Mr. Hagar. He is the first president of a cement company to be graduated from the sales department, and as such brings into the highest counsels of cement the particular kind of experience that has often been needed in the past.

His affable manners, cordiality and consideration for others makes him a charming companion; and his enthusiasm and courage incite admiration. These qualities have given him the nickname "Big Ben of Cement," and incidentally had a whole lot to do with his remarkable commercial success. By the same token the association and the trade may expect activity, for Benjamin Franklin Affleck is a doer, versatile enough to meet any emergency, and having a broad knowledge of the real needs of the industry in all its branches.

AMERICAN CONCRETE PIPE ASSOCIATION

The annual convention for 1916 of this Association will be held in Chicago, February 17 and 18, during the week of the cement show. A program of unusual interest is being prepared, covering different topics of importance relative to the manufacture and sale of concrete sewer pipe and drain tile.

Among the speakers will be Hon. A. O. Eberhart, ex-governor of Minnesota.

CEMENT SHOW

The Ninth Annual Chicago Cement Show will be held at the Coliseum, February 12-19, 1916.

The cement shows are instructive exhibits of cement products and appliances showing the wonderful progress in the cement field. Coming as they do at a time of the year when the engineer, contractor and dealer are somewhat at leisure, a very profitable day can be spent observing the modern methods, materials and economies in the concrete industries, that are exhibited.

* From "Rock Products," December 22, 1916.

826141

When a Man Builds a Machine

or produces anything, he works toward a definite end with the purpose for which his machine or his product is intended clearly thought out in advance. As a result, that man knows better than any other what his machine or his product can be made to do.

At the

Ninth Chicago Cement Show

Coliseum and Armory, February 12-19

the men who build standard concrete machinery, and whose ingenuity brings to light the new and wonderful possibilities of cement, will be present to tell Show visitors how to get the best results in concrete.

Can you work as well in 1916 without the specific knowledge of concrete products and concreting equipment that these men are prepared to offer you?

Under the Management of

Cement Products Exhibition Co.

210 South La Salle Street

CHICAGO

Luten Design Concrete Bridges

Indianapolis, Ind., November 24, 1915.

To the Editor:

Attached hereto is a copy of a letter which I have forwarded to the Attorney General of Kansas.

Very truly yours,

DANIEL B. LUTEN.

COPY.

November 23, 1915.

Hon. S. M. Brewster,
Attorney General of Kansas,
Topeka, Kansas.

My dear Sir:—

I have your letter of November 16th, in which you decline my offer of November 13th to come to Topeka to testify about the bridge trust. Your excuse is that Mr. Hawkes, Assistant Attorney General, who has had charge of my litigation, had gone to Iowa with State Engineer Gearhart to consult with members of the Senate Investigation Committee. I would remind you that my offer to testify in the bridge trust investigation has nothing to do with my litigation and that I advised you that I was free to come to Topeka any time during the past week. Mr. Hawkes returned to Topeka Wednesday morning, and thus had four days of the week still before him in which to call me.

In the Senate Investigation the Senate Committee on Patents is a judicial body. I have carefully refrained from attempting to bring my affairs to the attention of members of the Committee until called before it in the course of its regular procedure. You and State Engineer Gearhart failed to appear at the appointed time, November 8th. Mr. Gearhart has circularized the country with false and malicious statements about me, asking that letters be written to members of Congress to exert influence adverse to me, and giving as his reason that he was not satisfied with the due process of law afforded by the courts.

Now you inform me that you have sent your assistants with Mr. Gearhart for a conference with members of the Senate Investigating Committee and I learn that charges against me were made in my absence. I commend to you the sentiment of the following editorial that was published in "Portland Cement" of October, 1915, a technical journal published in Kansas City, Missouri:

"We realize that there are two sides to all disputes and it is our inclination to await the full presentation of both sides before passing judgment. We shall do this in the matter of the State of Kansas versus Daniel B. Luten and the so-called "bridge trust." But we are reminded by the highly sensational press dispatches emanating from Topeka that the time has long since passed when the State of Kansas can further delay the matter and maintain any semblance of good faith. The instigation of fraud order proceedings before the Post Office Department and investigations by committees of the United States Senate in no way throw any light on the question at issue. Perhaps it is unnecessary to say in connection with the proceedings before the Post Office Department that the effort was a dismal failure for obvious reasons. There is nothing now to indicate but that the Senate proceedings will result similarly. The State of Kansas represents too high standards and ideals to further countenance the methods being used in this instance."

I have also received a letter from your assistant, Mr. Hawkes, under date of November 18th, in reply to my offer of November 13th to come to Topeka. Mr. Hawkes advises that he will not wish to take my deposition until *after* he has filed suit in the bridge trust cases. I can only conclude that it has been determined in advance of the investigation who the defendants are to be and that he does not desire the information as to actual violations of the anti-trust law that I offered to give him but which may have no connection with the alleged suits that he intimates he may file some day.

I am disposed to question your sincerity and fear that your purpose is not to disclose infractions of the law but to whitewash your State Engineer. I am advised that you have had other offers of testimony which you have not accepted. I will, however, give you another opportunity to prove your good faith. On December 1st and 2nd the County Commissioners of Kansas meet in annual convention at Topeka. If you will advise me promptly I will be in Topeka December 1st to answer your questions. I suggest that you have State Engineer Gearhart present, and that the hearing be open to representatives of the press and to any others who may be interested.

In the Topeka Capital of November 19th, appears an interview with Mr. Hawkes entitled "Luten Never Asks Santa Fe to Pay Bridge Royalties." In February, 1914, I gave wide distribution to a circular entitled "Luten Patents and Litigation." On page 23 of that circular I stated my position relative to infringements as follows:

"Because of the profitless nature of patent litigation the principle has for years been advertised broadcast under the Luten patents that designers of infringing structures will not be prosecuted except when they oppose authorized Luten designs in favor of their own infringing plans. Thus where Luten designs do not attempt to compete there is no suit regardless of the amount of infringment. To avoid suit under these patents only one thing is necessary: either do not infringe, or if you will infringe be decent about it."

The Santa Fe Railroad has never opposed my authorized designs. Nor so far as I am informed has it ever infringed. Not so with Mr. Gearhart. He has not only repeatedly slandered and libeled me and my designs, but he opposed my plans at the Newton letting because the bids on his own design were higher than upon mine. The higher bid on his design included no royalty, although the design infringed patents of Luten, of Thacher and of Parmley, and his specifications infringed Luten copyrights. The lower bid upon my design included my royalty of ten per cent. This is quite apart from the fact that my design provided for a vastly better bridge than his. The Gearhart design of the Newton bridge was not in accordance with the best engineering practice of the day. Had Mr. Gearhart infringed my patents *decently* you would never have been called upon to defend suits against him for violation of my rights. My purpose in litigation is merely to create a fair opportunity for my plans to compete, and it is because Mr. Gearhart has endeavored to restrict competition that he is in trouble.

Very truly yours,

DANIEL B. LUTEN.

Stucco for Old and New Buildings

On a great many farms are to be found frame structures out of repair. They detract seriously from the appearance of the premises. There is a very simple method by which buildings of this kind can be made substantial and practically new. This is through the use of Portland cement stucco. Even dwellings of bad design are frequently remodeled by the use of stucco so as to appear like new and attractive structures. They are not only improved with respect to appearance. but are made thoroughly substantial and weather-proof.

Stucco is not expensive, and if properly applied is fire-resisting and enduring. It may be applied to brick and stone walls, concrete blocks and frame structures. In the case of frame structures the stucco is applied after the building has been covered with wood or metal plastering lath.

Materials

The materials composing stucco consist of Portland cement and sand with a small admixture of hydrated lime or slaked lime putty to give the mortar more plasticity. The lime also tends to whiten the stucco. The sand should be free from organic matter and uniformly graded from coarse to fine. The lime should also be uniform in quality.

The proportions for the first coat are 1 part Portland cement to not more than 2½ parts of sand by volume. Where lime is used 10 per cent by volume of the cement is the usual amount. In the first coat enough hair or vegetable fiber is added to insure a proper bond or key between the lath and mortar. The most satisfactory construction for the first coat is to plaster, if possible, on both sides of the lath, thus

A Brick House Built at State College, Ames, Iowa, in 1862. Becoming Dilapidated, It Was Restored With Stucco, as Shown.

thoroughly imbedding same. If this is not possible the lath is applied to sheathing boards and care must be taken to thoroughly force the mortar through the lath and in contact with the boards back of the lath. If this is properly done it will insure complete imbedment of the lath, which is particularly necessary where metal lath is employed, for it will prevent possibility of corrosion. As soon as the first coat is applied and before the mortar hardens the surface is thoroughly roughened by scratching with a sharp instrument or saw-tooth paddle. After the first coat has been applied and becomes hard the second coat is applied to the roughened surface of the first coat. Before doing this the first coat must be thoroughly wet down with water to prevent the moisture from being absorbed from the second coat. The proportions of the second coat may be the same as those of the first with the omission of the hair or fiber. The surface of this coat is roughened and dampened in the same manner as described for the previous coat. In the third coat the proportions are 1 part Portland cement to not more than 2½ parts of sand nor less than 2 parts sand by volume. Lime may be added in the proportion of 10 per cent of the volume of cement. It is sometimes the custom to use only two coats for ordinary

A Poultry House With Stucco Finish. This Attractive Structure Illustrates the Adaptability of Stucco to Farm Buildings.

work and in this case the third coat just described is the finish coat, the second coat being omitted. The surface finish decided upon, such as rough cast, pebble dash or float finish, is used on the surface of this third coat.

There are two very important precautions to be observed in the application of stucco. First, no stucco must be applied during freezing weather or if there is any possibility of the temperature dropping below freezing. Second, each coat must be kept damp and prevented from drying out by spraying or by hanging over the surface cloths which should be kept constantly wet. Cloths should be used where the stucco is exposed to hot sunshine.

Forms of Stucco Construction

Stucco is used in four general classes of construction, first, the over-coating of old frame structures. Second, application to new structures by the use of wooden or steel frame work with wooden or metal lath. Third, its application to old brick or stone structures. Fourth, its application to concrete block buildings.

The second class of work requires little description. The frame of the structure is built in the ordinary way, with lath and sheathing boards fastened to it and the stucco applied as described above.

In the third class, the mortar joints of the brick

or stone work are raked out to a depth of about 1 inch to form a key for the new stucco. The surface of the brick or stone is thoroughly cleaned and wet before applying the stucco. See that the stucco is forced into the joints to their full depth.

The fourth class is the application of stucco to Portland cement concrete block buildings. This is a very attractive and satisfactory method of construction. The concrete block, when intended to be covered with stucco, may be made with plain faces and no special attention is required to securing a smooth finish. Indeed, a rough finish insures a better bond between the stucco and the block. The mortar joints between the block are left open about 1 inch from the outer surface to insure a proper key for the stucco. The block is thoroughly wet down before the stucco is applied. Thus prospective builders who object to the appearance of the concrete block may combine the two materials and secure at once the strength and inexpensiveness of concrete block construction and the beautiful appearance of the stucco coating.

In all cases, whether structures are old or new, they should have firm foundations and be sufficiently rigid to prevent any settlement or sagging, which will cause stucco to crack.

FIVE-MILLION-GALLON CONCRETE RESERVOIR AT DULUTH

Duluth's new water supply reservoir is one of the largest circular concrete tanks in the world. The diameter is 183 feet and the walls are 23 feet high, 3 feet thick at the bottom, and 10 inches thick at the top. A depressed floor gives a depth of water at the center of 28 feet.

Since the walls of circular reservoirs take tension only, the steel reinforcing must be exceptionally well spliced around the circumference. Likewise the concrete should be placed continuously in order that there may be no joints between successive rings which might permit seepage. Except for the delay caused by a terrific windstorm on November 12, 1914, the tank was built in a continuous operation, forms for the outer walls being built up complete, reinforcing placed for

Five-Million-Gallon Reinforced Concrete Reservoir, Built to Insure an Auxiliary or Emergency Supply for the Water System of Asheville, N. C. It Is 150 Feet in Diameter at the Bottom and Is 40 Feet Deep. The Wall Is 3½ Feet Thick at the Bottom and Tapers to a Thickness of Eight Inches at the Top. George H. Davidson, Contractor, Asheville.

the entire work, the inner form built up as concreting progressed and concrete cast in a continuous operation.

One of the features of the work lies in the fact that no special precautions other than a wet 1:2:3 mixture of concrete were used to obtain water-tightness. It was considered amply sufficient to make a rich mixture and to cast continuously. The result has justified fully this belief, for little or no seepage has occurred since water was turned in except at the place where continuous casting was interrupted. Here dampness appeared for about three-fourths of the length of the joint and since the reservoir has been in use this damp area has diminished considerably.

The foundation of the reservoir is firm gravel mixed with hard-pan except for one-fourth of the floor area where rock was encountered. This was removed for one foot below grade and back-filled with well compacted material excavated from the other portion of the floor foundation.

One hundred and eighty tons of steel bars were received in lengths of 66½ feet. They were spliced with Crosby clips, such as are commonly used on wire rope. The bars were supported by vertical 3-inch channels extending to the bottom of the wall footings. At proper intervals notched brackets were riveted to the channels upon which the bars were laid.

The concreting plant consisted of a crusher taking rock from the reservoir excavation, a screen and a ½-yard mixer placed close to the wall on the upper side. A circular industrial track was built on top of the form system so that cars were filled at the mixer and made a complete circuit to and from the part where concrete was deposited. Sufficient aggregate was prepared before concreting began so that there would be no danger of shortage.

The floor was cast after the walls were completed. It consisted of a 10-inch reinforced concrete slab bonded to the walls by means of ¾-inch square bars, 7 feet long, placed on 2-foot centers. In addition, four concentric rings of floor reinforcement were placed next to the outer circumference instead of continuing the ordinary reinforcement at right angles as in the remainder of the floor.

The entire wall is supported by a 13-foot embankment which surrounds the reservoir, but no deduction in the amount of steel was made on this account, it being regarded only as an extra measure of safety. Work was done by D. H. Clough & Co., Duluth, Minn., under the direction of E. W. Kelly, engineer of the Water and Light department, who also drew the plans.

STEAM-DRIVEN HOIST HAS TWO SPEEDS

By simply throwing a lever, shift can be made from low to high speed without stopping the rotation of the drum or engine of the latest steam hoist to be placed on the market. Other special features of the machine are the band friction which eliminates end thrust, use of cut steel gears entirely, composition lined brake bands, special engine design for heavy service, and a valve design which gives "straight line action" on the valve rod. The connecting rods are made solid on both the crank end and the cross-head end.

The hoist is equipped with a double-cylinder 8x10-in. engine which, when operating at 125-lb. steam pressure, gives a cable speed of 150 ft. on low and 450 ft. per minute on high with a tension of 15,000 lb. and 5,000 lb. respectively.

One of the particular purposes for which this hoisting engine was built was that of operation in connection with drag scrapers and cableway excavators. The low speed is used for loading and the high speed for hauling in to dump.

It is not ordinarily fitted with an upright boiler although provision is made should the user require it. It is the belief of the manufacturer, the Thomas Elevator Company, 18 South Hoyne avenue, Chicago, that this hoist should be operated with a locomotive type of boiler because the continuous service required of a machine working on cableway excavators, requires greater steam consumption than the intermittent duty of the ordinary hoisting engine.

CEMENT AND ENGINEERING NEWS

(PUBLISHED MONTHLY)

WILLIAM SEAFERT, Editor and Publisher

Office—672 Transportation Building, Chicago

Telephone, Harrison 5397 Cable Address, "Seaferts" Chicago

Entered at the Post Office at Chicago, as second-class matter, July 21, 1896 under Act of March 3, 1879

SUBSCRIPTION RATES:

United States, Canada, Philippine Islands and Mexico, two years for $1.00; all other countries, $1.00 per year.

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Advertising copy or changes in ads. must be in this office by the 25th of each month, as hereafter our magazine will appear on the 5th of the following month.

Advertising Rates Sent on Application

JOHN F. WALDRON - - - - - - - - Advertising Manager

CHICAGO, JANUARY, 1916

USES FOR THE MOTOR TRUCK IN THE CONTRACTING FIELD

Every big contracting job to-day has the steam shovel, concrete mixing machines, mechanical hoisting devices and other modern machinery to do the work with the greatest speed and efficiency—which shows that contractors are very ready to adopt mechanical labor and time-saving devices in their working equipment when the merit of such machinery has been proven to them.

Motor truck manufacturers believe, therefore, that supplying motor trucks to contractors for performing the work of hauling, which is more or less a part of every contracting job, will in the near future form an important source for the sale of their product.

This article points out many advantages to be gained by replacing horse-drawn hauling equipment with the speedier and more efficient motor truck.

If it is advisable to mix concrete by machinery instead of by hand; to excavate with steam shovel instead of with hand shovel, then it is advisable—in fact, necessary—to do the hauling on the job with motor trucks instead of horse trucks because the reasons affecting the choice between these related methods are parallel in every way.

This assertion applies with added force when it is considered that *hauling is the limiting factor on every part of the contractor's work.* Speed up the hauling and every department of the work will be hustled. The output of the mixing machines, for instance, depends upon the supply of material, and likewise the work accomplished by the steam shovels depends very often upon the facilities for removing what is excavated.

It is not an uncommon sight when watching a contractor's outfit at work to see perhaps a $15,000 steam shovel or other expensive equipment tied up at frequent intervals because the horse trucks doing the hauling are not keeping up to the pace. In the course of a job this idle time runs into much money.

When the large investment tied up in the expensive machinery necessary to run a big contracting work is considered, it is certain that any contractor will welcome a method that will help him get the most out of his machinery. The ability to accomplish this result is, from a contractor's standpoint, one of the most valuable advantages offered by the use of motor trucks.

"Time is money," is strikingly true in the contracting business. Motor trucks are time savers and efficiency factors—therefore money savers. On penalty or bonus contracts and rush jobs the speed and efficiency of motor trucks is especially valued; on any job good progress stands for profit.

On big construction jobs it is sometimes necessary to work the horse trucks in two shifts of ten hours per day or three shifts of eight hours per day. This change of hauling equipment every few hours would be unnecessary if motor trucks were used—a motor truck has no limited working day—just like a steam shovel or other machinery they will keep working as long as they are properly handled.

One heavy service dump truck, with power-driven dumping device, will accomplish as much as four to eight teams and wagons. Consider the advantages of this reduction in the number of hauling units, also the saving in labor costs.

The problem of feeding and housing teams and wagons, every contractor knows, is a troublesome one—it takes a well organized department to look after this work alone. Motor trucks require only a fraction of the shed room that would be needed for horses and teams of the same working capacity and it is far simpler to handle the gasoline and oil for the motor trucks than the hay, grain, bedding, harness, etc., required for horses.

When moving the outfit from one job to another the shipping of motor trucks is easy compared with the job of moving teams and wagons. Very often the motor trucks can cover the distance on their own power, carrying much of the other equipment with them.

On all urban work, such as the construction of sewers, bridges, buildings or excavation work, contractors can use motor trucks with profit and get more satisfactory service from their hauling equipment than they have ever experienced before.

On rural or isolated jobs the advantages of motor trucks for hauling, out-distance those of any other transport method beyond any comparison.

SAVING THE ENTIRE CORN CROP WITH CONCRETE SILOS

From 30 to 40 per cent of the nutritive value of the corn crop is contained in the leaves, husks and stalks. How to get the most out of this 30 to 40 per cent and at the same time perpetuate the producing power of the soil is the question which every farmer who grows corn should consider very carefully.

When the stalks are left standing in the field after the ears have been picked, even though the cattle are turned in to feed in the fall, a large part of the food value is wasted, much of it being trampled down or left uneaten because it is too fibrous or woody. This method of feeding is doubly unsatisfactory, owing to the difficulty experienced with the uneaten stalks when preparing the fields for the next crop, as they are hard to plow or disk under. When the stalks are cut and fed dry there is not only a waste due to the fact that much will be uneaten, but there is also a loss of food value in the drying process. On the other hand, if the whole crop, ears and all, is cut at the right time and put into a silo, not only is the harvesting expense reasonable, but the full feeding value is preserved and owing to the succulence and palatability the cattle will eat every particle of it and, if the manure is hauled out and spread on the fields again, the maximum amount of soil fertility will be retained.

Countless experiments at the various state and college stations have proved that ensilage is an ideal food when balanced with the proper concentrates. Of late years large beef raisers and general farmers have felt the need of a more economical ration and have turned to ensilage as their salvation. Up to a short time ago beef breeders believed that ensilage was too succulent a ration and that cattle fed much of it would not harden and consequently would be rejected by the packers. This was proved to be a wrong supposition and we now know that the best beef can be produced and the best prices secured by feeding ensilage.

The characteristics of ensilage make it pre-eminently a feed for dairy cattle. It is palatable, succulent, bulky, beneficial to the digestive tract and very economical. In fact, most farmers in the dairy business realize that to secure the best results they must feed it, as ensilage-fed herds do not fall off in milk flow during summer droughts or through long winter months and produce from 11 to 13 per cent more milk than cows fed dry fodder from the same acreage. Contrary to the opinion formerly held, the milk from ensilage-fed cows is not inferior in flavor or odor to the milk from cows dry-fed. Condensed milk companies that formerly did not favor milk from silage-fed cows are now advising their patrons to use ensilage.

Much discussion has arisen concerning the feeding of ensilage to horses. At the outset, a good quality of ensilage absolutely free from mold is required. Some farmers have fed silage to brood mares and horses at rest during the winter with good results. On the other hand, some have lost horses on account of the mold that ensilage sometimes contains. The Pennsylvania Experiment Station fed ensilage to fattening geldings with quite satisfactory results, but it is hardly to be expected that it would prove sufficient for horses at heavy work.

Sheep are natural grazers and suffer most quickly from being changed from rich pasture to dry feed. Ensilage, because it has the palatable nutritive properties of rich pasture, makes the growth of the flock regular and continuous. For breeding ewes it produces a good healthy lamb and a good flow of milk at lambing time. Ensilage used alone forms a nearly perfect balanced ration for sheep and is the cheapest, and at the same time, the most effective feed that can be used.

Corn, sorghum, clover, alfalfa, cow peas, soy beans, oats, rye, Kafir corn and milo maize are the crops most generally used for making ensilage. Corn is the king of all silage crops as it not only returns a greater yield per acre, but it contains more essential elements that go to make up a satisfactory ration.

To the concrete contractor seeking a profitable outlet for his activities in a line that will grow very fast the Polk, Genning-Polk Company, Fort Branch, Ind., will send a message in the shape of literature that will instruct and convince. The silo building system developed by this concern has been in extensive use in all parts of the country and much of the present popularity of the all-concrete silo is due to the pioneer work done on the Polk System. Write for the recent booklets and silo data. The Playford Mfg. Co., 298 Douglas avenue, Elgin, Ill., have a new principle invented in cement stave silo construction. Those who have seen it—and who have made searching comparison with Mr. Playford's earlier efforts in cement stave silos, are united in saying that this invention creates a new standard by which silos must now be judged. Write for Playford Company circular, prices and further information.

SLAG CONCRETE CONSTRUCTION

An immense reinforced cotton warehouse nearing completion at Atlanta, Ga., is built throughout with slag concrete, which the Birmingham Slag Company of Birmingham, Ala., has been furnishing for the past two or three months at the rate of from three to eight carloads per day. The company has also just closed a contract for purchasing blast furnace slag to be used in the construction of the new Emory University at Atlanta, Ga. The contractor for this job will require shipments of slag at the rate of about two carloads per day for an entire year.

The Union Terminals at Macon, Ga., about to be erected, were designed by Mr. Alfred Fellheimer, architect, New York, N. Y., who included slag in the specifications, and both Mr. Fellheimer and Mr. C. K. Lawrence chief engineer of the Central of Georgia Railway, both instructed the contractor, J. Henry Miller, Inc., Baltimore, Md., that they preferred slag over either stone or gravel.

The new reinforced concrete bridge across the Cuyahoga river at Akron, Ohio, was constructed of slag concrete. Important reinforced slag concrete structures, almost without number, have been erected in Cleveland, O., during the past six or eight years. The Carnegie Steel Company, about two years ago, erected a five-story pattern warehouse of slag concrete, the walls of which are 20 inches thick at the bottom and 12 inches thick at the top, are not reinforced at all, although reinforcement was, of course, used in floors, columns, etc.

In the city of Birmingham, Ala., slag has been used in the construction of all the public blocks and the prospect is very bright for the erection of a great many reinforced slag concrete structures during the next 12 months.

DRAIN-TILE BOOM IN SIGHT

Indications from all parts of the country are that there will be more drain-tile used by the farmers during 1916 than ever before. No doubt an increased number of cement products plants will take on tile manufacture as an added line, or will be newly installed, to meet the demand.

Not one-tenth of the tillable land of this country has yet been drained. And now that ditching machines can be had which can be operated any season of the year, and which will lessen the cost of trenching three-quarters as compared with hand labor, there no longer remains the excuse that farmers have hertofore had, a scarcity of labor or the annoyance of boarding men while the work is being done.

It is safe to say that a demand for fully double the amount of drain-tile now being sold is already created, and would be supplied if modern plants could be established in locations where excessive freight rates were avoided, and a large stock carried to supply the tile when needed.

FORMER SUPERINTENDENT SANDUSKY CEMENT CO. IN BUSINESS, AS CONSULTING INDUSTRIAL ENGINEER

Mr. F. L. Jorgensen, for the past two and one-half years general superintendent of the Sandusky Portland Cement Company, has resigned to go into business for himself as consulting industrial engineer, with offices in Cleveland, O. Crushing, pulverizing and conveying machinery are his specialties.

New Plant of the Atwood-Davis Sand Company

One Device, Unique with the Plant, Which Mr. Geo. B. Parker, the Superintendent Devised, Is the Use of Hopper Cars, Which Feed Gravel, Under Control, on Belt Conveyor. The Plant Is Electrically Operated Throughout with Unit Drive Motors.

The Atwood Davis Sand Company of Beloit, Wisconsin, operate a large and modern plant for preparing gravel for concrete and other commercial purposes, and for railroad ballast. It is considered to be one of the largest gravel washing plants in the country. They have recently opened up a new pit. The plant and tracks cover about 20 acres of ground west of the old pit, which consists of 37 acres, same having been worked out in the past ten years.

The Atwood-Davis Sand Company. Looking Toward Plant From the End of the Pit. Shovels Loading Hopper Cars in Foreground. C. & N. W. Trestle in Background. The Plant May Be Seen in the Distance.

The plant is situated about one mile sout of Beloit on the Madison Division of the Chicago and Northwestern Railway. About three years ago it became apparent that the pit then worked would soon be exhausted. Negotiations were at once commenced for obtaining an option upon 80 acres of an excellent bed of sand and gravel, covered with but three feet of overburden to the west of the old pit. This property lies on the other side of the Northwestern double tracks, which run about 100 feet from the crusher plant.

Problems Encountered

Operations were started on the new pit on April 7th, the demand at the busy season with our capacity of 300 tons daily. We either had to put in an additional are in the fruit country where we could not handle of this year. The problem which confronted Mr. George B. Harker the superintendent was two-fold.

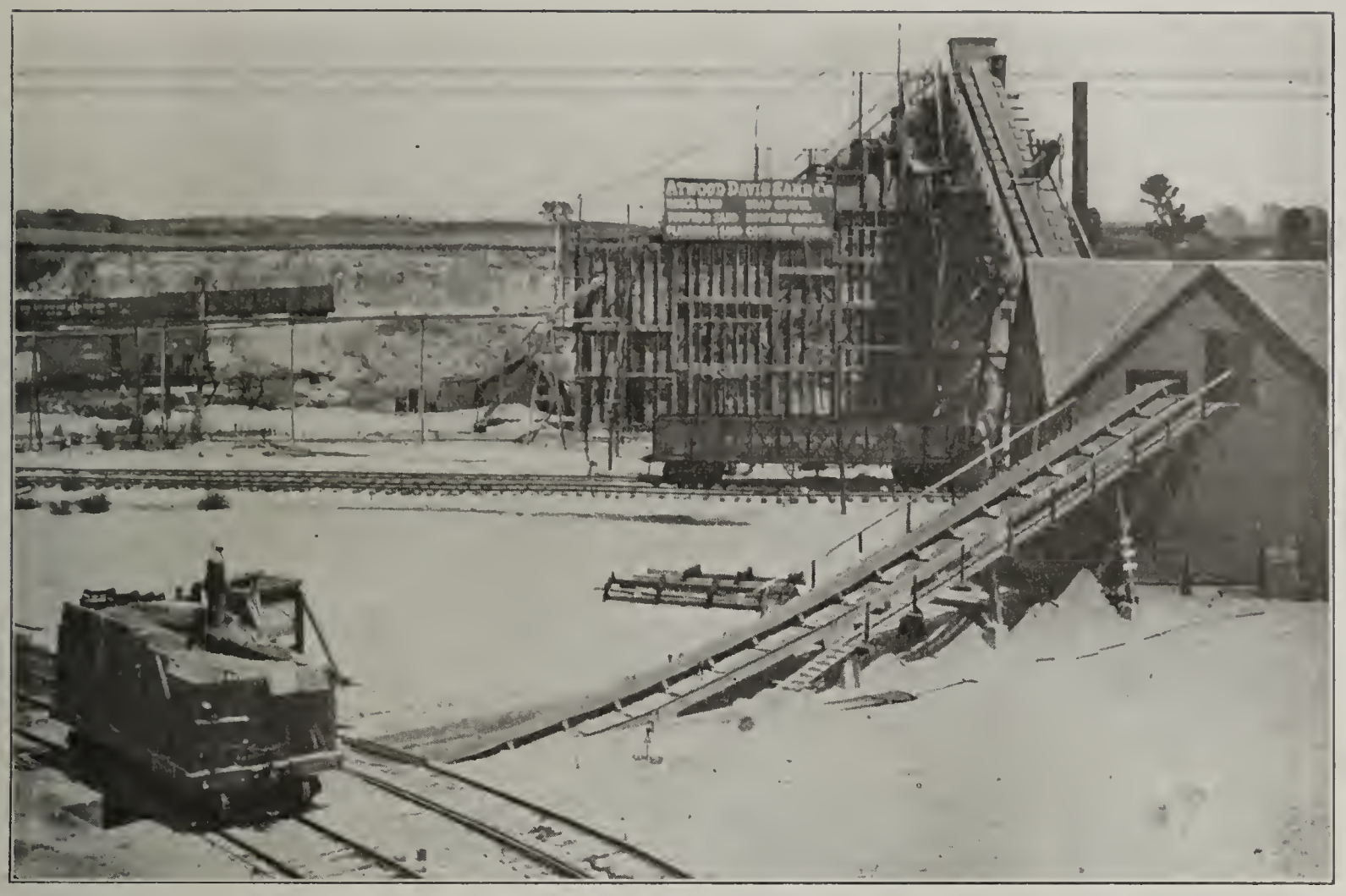
First—It was necessary to tunnel under the double track of the Northwestern Railway and construct a bridge without interfering with the traffic or holding up the plant.

Secondly—This also called for the opening up of a throughcut a half mile in length (the depth of the new property), with a bank 38 feet in height, having a top width of 140 feet and a 55-foot bottom.

The company at this time had a 70-ton Vulcan steam shovel with a 3 cubic yard dipper. Although this shovel alone had sufficient capacity to supply the plant under ordinary conditions, obviously this was impossible when carrying a throughcut. Consequently the company found it necessary to use a Bucyrus revolving shovel, equipped with a 7/8 cubic yard dipper, fitted with a sand lip. This shovel had been used in 1914 for stripping and for excavating the approach to this cut up to the railroad embankment.

Construction of Bridge

Falsework for the bridge was driven under the outside or far track, the piles being driven to a depth varying between 9 and 12 feet. There were 9 bents, 12 feet apart, with 5 piles to the bent. The steel and bridge timbers were then placed. This track was then thrown open to traffic and the first track was torn up to allow the shovel to excavate up to the false work which had been driven under the far track. Then the piles for the permanent bridge were driven, having a 36-foot span, on which was placed a 40-foot iron girder. The near track was now thrown open to traffic and the far track and falsework, first driven, were removed. The wide span under the first track was necessary in



Gravel Washing and Screening Plant of the Atwood-Davis Sand Co., Beloit, Wis. Hopper Car at Left Feeding on Belt Leading to Preliminary Crushers, Which Are in the House in the Foreground. Plant Equipped With "Rexall" Double Stitched Conveyor Belting Furnished by Imperial Belting Co., Chicago; 36-Inch Symons Disc Crushers Furnished by Chalmers & Williams; Two Gates Crushers Furnished by Allis-Chalmers Mfg. Co.

order to allow the revolving shovel to operate between the piling, while excavating the material from under the far track. After the shovel had dug through and passed the far track, then the permanent bridge was put in for the far track.

The bridge was completed in 21 days without delay to railroad traffic, the plant only being delayed two days, as the material taken from under the bridge happened to be marketable sand and gravel.

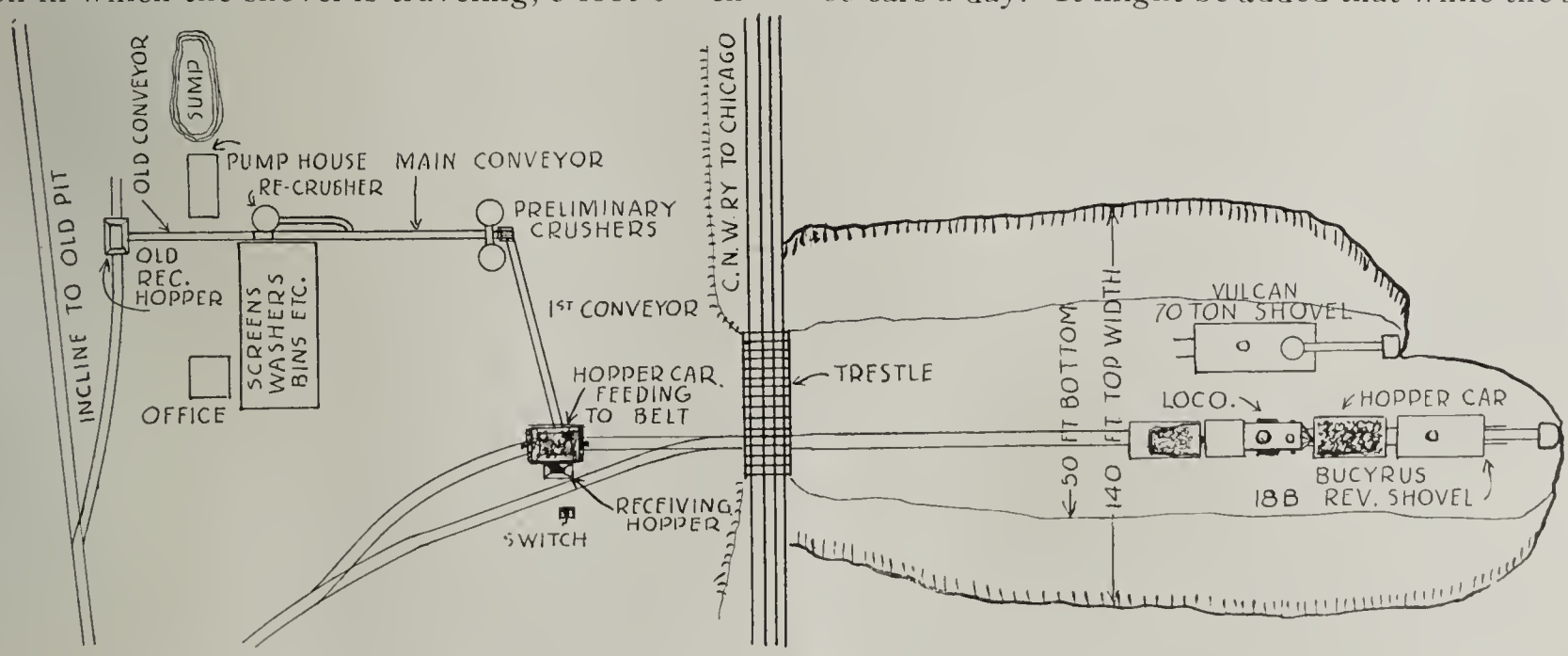
Working the Throughcut

The method of working the throughcut in order to get the greatest possible output, is as mentioned before, most ingenious.

The Vulcan shovel is proceeded by the revolving shovel; the latter carries ⅔ of the breast with a height of 38 feet, which cut, as stated, measures about 140 feet top width. Ties are laid in front of this shovel as it advances. On these ties are placed, parallel to the direction in which the shovel is traveling, 5 foot 6 inch blocks, made of two 6 inch by 8 inch timbers bolted together. Two of these blocks form the foundation for a timber float, 5½ feet wide, 14 feet long, 6 inches thick. The shovel operates with three of these floats. The blocks between the ties and floats are used to keep a space so that the rails can be slid in under the float, as this standard gauge track serves as the loading track for both shovels.

The big shovel follows the small one to the left. The shovels are so placed that both load the hopper car at the same time, as may be seen from one of our views. The time consumed for this operation averages about 2½ minutes a car. Two cars are used with one 55-ton locomotive. Each car has a capacity of about 22 cubic yards. When the plant is in full swing a car is brought to the shovel every 8 minutes.

The average output per day under ordinary conditions is 45 cars or about 1,350 yards in ten hours. This output can easily be increased to 1,600 cubic yards or 55 cars a day. It might be added that while the shovels



Plant and Pit of the Atwood-Davis Sand Co.

are waiting for the car, the 18-B in order to keep ahead of the Vulcan, overcasts in front of the latter.

It is planned to abandon the revolving shovel when the throughcut is made and use the Vulcan shovel only for that work.

The Pit Equipment

One device, unique with the plant, which Mr. Harker has devised, is the use of hopper cars which we have mentioned. These cars obviate the use of a receiving hopper over the belt and consequently the necessary hump or grade of about 22 feet in order to bring the cars over the mouth of this hopper. This device

Hopper Car Feeding on Belt. Note the Flow of the Gravel and the Extra Bunker on the Locomotive's Tender Described in Our Text.

greatly simplifies the track lay-out. Each car is equipped with a device whereby the material is fed under control on the conveyor.

From one of our views, it can be observed that the tender of the locomotive has been extended to carry on its rear end, a coal bunker. This bunker holds a day's supply of coal for both shovels. It is loaded by the night man. This arrangement has been necessitated by the impossibility of getting coal to the shovels without greatly delaying operation. By this ingenious method of Mr. Harker's, no delay is incurred.

The water supply for the shovel boilers is obtained by ¾ inch ejectors connected by means of 20 feet of 1 inch suction hose to 1¼ inch well points driven to a depth of about 10 feet. It is only necessary to drive a well point once to every 40 feet that the shovel moves ahead. The shovels are working at water level.

It will be observed from our sketch that provision is made for a double track over the receiving end of the first conveyor belt, so that one or the other of the two hopper cars are continually feeding onto the belt. The conveyor is fed by one spout, located between the two racks. Consequently the material is delivered from the right side of one car and the left side of the other, so that one car can be discharged from one track while the second car is being loaded and brought up. An interlocking switch device operating both switches at the same time, has been designed by Mr. Harker.

The Plant

The plant is electrically operated throughout with unit drive motors. The material is fed from the hopper cars on to an 8-ply, 30-inch Rexall double stitched conveyor belt measuring 115 feet in length, between centers. This belt has an elevation of 22 feet and is driven by a ten H. P. motor. It was manufactured by the Imperial Belting Co., Chicago. It delivers the material over a taper-bar grizzly. This grizzly has 16 bars 9 feet long spaced 1¼ inches on the upper or delivery end and 1¾ inches on the lower end, in order to prevent clogging. The oversize is fed to a pair of No. 4 Gates crushers which reduce it to 1¾ inches. The two crushers are only used when the plant is fed to full capacity. The advantage of having the pair is obvious, as under ordinary conditions, one may be used while the other is being repaired, without delaying operations. These crushers are driven by 20 H. P. motors.

From these crushers the gravel is fed on the main "Rexall" double stitched conveyor belt on top of the sand and small gravel that passes through the grizzly screen. This belt is 8-ply, 30-inch and 374 feet long, and was also furnished by the Imperial Belting Co., Chicago. It carries the material to the top of the plant, where the recrushing, screening and washing machinery are placed. Gravel over 1¼ inches in size is re-crushed by a 36-inch Symons disc crusher (manufactured by Chalmers & Williams, Chicago Heights, Ill.) driven by a 35 H. P. motor.

The washing and screening plant consists of 6 sets of screens which screen the gravel into four different sizes. These screens as well as the main conveyor, are driven by a 35 H. P. motor. The last two sets of screens deliver what is known as the No. 2 and No. 0 sand into four settling tanks, two for each screen. Here the sand is separated from the mud and clay which passes off in solution. All four of the settling tanks were designed and built under Mr. Harker's supervision.

The water for the washing plant is obtained from a sump 250 feet long, 40 feet wide, and 8 feet deep, in which a good supply is always obtainable, as it is dug below the water level. This water is pumped by an Erie 6-inch centrifugal pump driven by a 20 H. P. motor at 1,100 gallons per minute to a 74-foot elevation.

The changing over from the old pit to the new property, meant the changing from steam power to electricity, also the building of a new conveyor to the west side of plant instead of from the east side, the installing of a new Symons Disc crusher, the moving of four Gates crushers from the plant to the new crusher house, also the building of a short conveyor from the hopper car track to the crusher house, instead of old style hoppers. Mr. Harker planned all this work and superintended all the construction and installation of machinery with the regular force of men that run the plant and shovels. This new work was done in the winter months while the plant was closed down, from December 16th, 1914, to March 6th, 1915.

Mr. Harker claims to be the originator of both methods of using the two shovels for through cut work, and of feeding the material direct on the belt from the hoppers. He claims both methods far superior to any other.

HAULING CEMENT BY MOTOR TRUCKS MORE ECONOMICAL

The haulage of cement is distinctly in the heavy-duty class. The experience of the New England Cement Company, Fall River, Mass., is an interesting commentary on the greater economy of trucks for heavy-duty service. Four two-horse teams have been replaced by a three-ton motor truck. The truck averages 65 miles a day carrying a capacity load. The cost of the horse equipment 365 days in the year is $6,530. The combined wages of four men $1,800; total, $8,330. As against this, the fuel and oil cost of the motor truck was $650, repairs and overhaulings aggregated $370, interest on the investment at six per cent (investment of $3,800), depreciation at 20 per cent and also wages of driver. The total operating expenses of the motor truck for one year is $1,350.02. This leaves a balance in favor of the truck of $5,014.98. The insurance is not included in this figure, but estimated at $150, the net balance in favor of the truck would be $4,864.98.

Zagelmeyer Granite Blocks at the Cement Show

A demonstration by the Zagelmeyer Cast Stone Block Machinery Co., 25 Crump Avenue, Bay City, Michigan, showing how cast blocks with granite faces are made, will be given each day during the Chicago Cement Show, which will be held at the Coliseum February 12th to 19th. A 30-mold car of these blocks will be made each day at a certain hour at Booths 205 and 206, in the Annex. The Zagelmeyer company will also have a very attractive display at Booth No. 107 in the main building.

The Zagelmeyer System

Producing an absolutely water-proof hollow cement building block with a sparkling granite veneer facing at a reduced cost of manufacture, made possible by casting the blocks from patented multiple molds, constitutes the Zagelmeyer System—the process that has revolutionized the cement block industry and is fast eliminating the old objectionable dry tamp method from existence.

The Zagelmeyer System affords positive protection to block makers securing Zagelmeyer casting molds and territorial manufacturing process rights to enter a profitable business without fear of competition; enables you to turn out a more superior product than is possible by any other method and at less cost, and furnishes you with a monopoly legalized by the United States Patent Office by which patent grants you can build up a protected business that will be highly profitable, writes Mr. Zagelmeyer.

The Zagelmeyer Cast Stone Block Machinery Company not only manufactures the machinery and molds necessary to cast water-proof granite veneered cement blocks, but also operates the two largest cement block manufacturing plants in the world. Being pioneers in the business and having experienced a wonderful yet natural growth in production volume at both our large Bay City and Detroit block plants and having watched, analyzed and studied the growth of demand for a building block that was practical as well as possessing superior appearance, we cannot help but feel qualified to successfully guide and advise others desiring to follow our methods.

The Attractive Concrete and Brick Residence of J. Fletcher Skinner, Manager Sears, Roebuck & Co., in Oak Park, Ill.

There is no question whatsoever as to the permanency of the steadily increasing demand for Zagelmeyer granite faced blocks. Their beautiful appearance, great strength, imperviousness to moisture and low cost have won favor wherever used—the remarkable growth of every plant using our molds is proof sufficient that the Zagelmeyer System has solved the cement block problem, overcome all the defects of

blocks made by other methods and placed the cement block among the foremost of building materials.

The Zagelmeyer System Eliminates Competition

By the Zagelmeyer System you can make waterproof granite-veneered blocks, either smooth or rock faced, at less cost than you can turn out an inferior block by any other process—you can sell them for more and, by reason of their greater strength, durability, quality and adaptability to many new construction purposes, you can sell more of them.

You can obtain the exclusive right to manufacture these blocks in your territory—we give you absolute protection against competition and you can build up a business without fear of cut prices putting an end to your enterprise. Only in the Zagelmeyer System will you find a guarantee like this.

SPECIAL LINE OF DERRICKS

A line of builders' derricks that deserves the special attention of Cement & Engineering News readers is being offered by Sasgen Derrick Company.

The Sasgen Reinforced Circle swing builder's derrick shown below is without question one of the most practical hand power derricks made for building and structural work, loading and unloading cars and wagons from platforms, well digging and various other purposes. It can hoist 300 feet. The fittings on this machine are all crucible steel and malleable, including the geared winch, which makes the derrick safe and durable. They can make this derrick if so desired to be used by hand or power for an additional $3.00. It is 8 feet in height, weighs 350 pounds, and has a circle swing of 10 feet. It is equipped with 150 feet of cable, swivel block, fasteners, band brake for load, boom brake to keep boom from swinging when hoisting. It has a hoisting capacity of 2,500 pounds.

The Sasgen pole derrick is extensively used by builders for setting posts, girders, joists, stone coping, etc. This derrick weighs about 200 pounds, is

equipped with winch, 100 feet of cable and block. It is made of 5½x5½ selected Norway, provided with extension sheave frame. The fittings are of best malleable castings.

The improved setter derrick is another product of this company. The top frame of this derrick is made of the best malleable iron, is equipped with two sheaves, which eliminates the block on top. This frame is supported by ⅝-inch truss rod and has lugs for guy lines in front and back, also clamps for fastening extension pole. The bottom and side pieces are connected with two malleable castings and fastened by means of bolts so the derrick can be easily taken apart if necessary for shipment or removal. Sasgen Derrick Company, 2052 North Racine Avenue, Chicago, also manufacture derricks made entirely of steel. Write for catalog No. 15.

GOOD ROADS AND THE MOTOR TRUCK

Permanent Highways Will Lead to Extensive Adoption of Auto Truck Hauling in Preference to Rail Transportation, Where the Distance Is Within a Half Day's Run

Successful competition of the commercial auto truck with the steam and electrical railroad in the hauling of short-distance freight and passenger business, is given as one reason for extensive road improvement, in the report of the Joint Congressional Committee on Federal Aids to Good Roads. Discussing this phase of the subject, Hon. Jonathan Bourne, Jr., chairman of the committee, says:

"A great system of rural transportation would be developed, with rates regulated by actual competition, open to rich and poor alike, as no expensive privately owned terminals, roadbeds, tracks or equipment would be required. The good wagon roads would be open everywhere to the use of everybody, and the equipment, relatively inexpensive, would be within the means of many.

"This suggestion as to the use of rural roads by commercial auto trucks and buses is not merely a product of imagination.. In several instances gasoline propelled buses are now competing successfully with city or interurban electric lines, and, where the haul is but a few miles, transportation of freight by auto truck is found cheaper and more satisfactory than transportation by rail.

"In the case of the short haul, the saving in handling and in time more than counterbalances the lower rail rate. Instead of loading the commodities on a truck, unloading at the local railroad station, where they must be loaded upon the cars, hauled to the near-by city and then unloaded and again loaded upon a truck and hauled to the consignee, the user of an auto truck who has a hard surface road available loads his products once, hauls to the door of his consignee and unloads, saving not only the handling but the time, the inconvenience of issuance of way bills and receipts, and avoids damage to goods or deterioration while in transit.

"We believe that permanent highways will result in very considerable adoption of auto truck hauling in preference to rail transportation, where the distance is within a half day's run."

REINFORCED CONCRETE FACTORY BUILDINGS

A paper read by F. W. Dean at the convention of the American Society of Mechanical Engineers presents the advantages of reinforced concrete for the use of factory buildings, such as fire-resisting qualities, great window area, and good lighting, and also some of the disadvantages. It also points out that regular mill construction buildings have shown their fire-resisting qualities when properly designed. The best methods of finishing the floors are discussed and also the application of wood as a wearing floor above the concrete. The difficulties of fastening shafting hangers and machinery are brought out and the extra cost of drafting in consequence of this, as well as the great care required in making provision for everything to be installed. The different methods of constructing floors and the different forms of ceilings are taken up and also the relative costs of concrete and regular mill construction buildings.

Patented Concrete Bridges

By Daniel B. Luten, Consulting Engineer, Indianapolis

A patent is an agreement between the United States Government and an individual who has perfected a new and useful improvement in art or manufacture. The government for its part of the agreement grants for seventeen years the right to exclude others from making, using or selling the patented improvement. The individual for his part gives complete publicity of the improvement in such explicit terms that anyone skilled in that particular art may be able to reproduce the improvement after the patent has expired. The reason for granting exclusive rights in the improvement is not so much a reward for originating the improvement as for giving it publicity. For every individual who originates an improvement of any kind is the owner of that improvement. If he chooses to keep his improvement a secret he may prevent others from making it for an unlimited period provided he can maintain its secrecy from all others. Were it not for patents, therefore, improvements would often be kept from public knowledge for an indefinite period.

To prevent suppression and secrecy of improved methods the reward of a patent is offered by the government for complete disclosure of the improvement. It is for this reason that the patent consists of drawings and specifications as well as the claims, which latter are intended to present the applicant's idea of his improvement in the most accurate language possible.

Heavy loads and high speeds have compelled the building of hard, smooth roads for modern traffic. These hard, smooth roads must be continuous even across rivers and ravines. Hence, it no longer suffices for a bridge to carry traffic across a stream. A bridge is today an engineering structure that carries the roadway itself across the obstructing river. Carrying such loads, and with but intermittent attention as is usual on highway bridges, a bridge must needs be a permanent structure, provided the cost is not excessive. Concrete bridges, properly selected as to type and properly designed, are permanent structures, requiring no painting, no repairs, fire-proof, flood-proof, frost-proof and rust-proof.

Since traffic is constantly increasing in volume and in weight, a bridge to be permanent must either provide in advance for the increase or else must have provision for increase in strength and capacity with the traffic. Concrete increases in strength with age. Hence the concrete arch, which employs concrete in compression, also increases in strength with age. This increase amounts to approximately 50 per cent in the year following the first month. An earth-covered concrete arch increases in strength additionally by reason of the compacting of the fill over the arch and back of the abutments.

A bridge that has its roadway supported from below can be widened at any time without loss of the original investment. A bridge in which the supporting trusses or girders project above the roadway will usually require complete destruction of super-structure for widening; hence such a bridge is not a permanent bridge even in concrete unless adequate provision has been made in the original design for all future increase in volume of traffic. The earth-covered concrete arch fulfills the requirement, for it can be widened at any time without loss of anything except the railing. And when widened it can also be modified in the design to present a more elaborate appearance. The common practice in Ohio is to build bridges with roadway 16 feet wide. New Jersey recommends 30 feet and Maryland 24 feet because the traffic in those states can no longer be accommodated on narrower bridges.

An efficient, safe and economical concrete arch-bridge can not be designed at the present time without infringement of patents. The earliest of the patents now applying to concrete bridges is Thacher, 617,615, January 10, 1899. Application filed October 17, 1896.

It may be argued that this patent does not cover bars in pairs connected at frequent intervals, since the claims read on bars independent of one another. There is, then, the patent to Arnold, 749,771, January 19, 1904; application filed September 13, 1902, which covers any arch with reinforcement of rails or other iron bound together at frequent intervals. Another patent is: Melber, 660,518, October 23, 1900; application filed August 24, 1899, in which shear members cross diagonally from the one reinforcing member to another but unattached to the other reinforcing member.

If the Thacher patent be limited to bars in pairs one vertically above the other, there is, then, Parmley, 696,838, April 1, 1902; application filed June 4, 1901, in which bars near intrados and near extrados alternate with one another.

The patent to Luten, 1,009,676, November 21, 1911; application filed April 29, 1901, covers a single row of reinforcing members. And Luten, 818,386, April 17, 1906; application filed May 17, 1902, covers several series of rods arranged singly but crossing the arch at different points. The theory of this reinforcement is that tension will occur at alternately opposite edges of an arch in limited regions only and the steel is located in those regions and extends continuously from one to the other for convenience in placing. A similar object may be accomplished with non-continuous rods as shown in Luten, 852,971, May 7, 1907; application filed June 30, 1906, but the saving in steel is far more than offset by difficulty in placing.

The only other possible solution for reinforcement of a concrete arch is believed now to be with the steel located near the neutral axis, not an efficient arrangement. The concrete arch may easily be designed to avoid infringement by omission of all steel reinforcement, but it is doubtful if efficiency or economy would be possible.

From 1890 to 1900 approximately three patents a year were granted on concrete construction. From 1901 to 1910 the number issued annually increased from six to upwards of 150 a year. Since the subject of reinforced concrete construction and its improvement is a branch of civil engineering, this increase in number of patents must be of vital concern to the civil engineering profession.

Of all professions the profession of civil engineering ought to look with most favor on patent protection. For it is the profession above all others that is most concerned with advancement and improvements in science and the useful arts. And it was for the promotion of progress in science and the useful arts that Congress passed the patent law.

But does the civil engineering profession require any reward or incentive to make it do its best? Most assuredly it does. Civil engineers are frequently isolated in the practice of their profession and are rarely forced into competition except in securing employment. Once the civil engineer is retained for any

particular work, he is usually freed entirely from competitive incentives, and he may design crudely and inefficiently with far less chance of detection than in any other profession or trade. A single collapse of a bridge or building, due to overzealous attempts to secure efficiency in untried fields, condemns the entire profession in the public mind, while designs wasteful of materials and methods receive approval because the structures stand.

Lacking the usual spur of competition, therefore, the only incentive remaining to civil engineers to give publicity to their improvements is through technical journals and societies. The net result of which is that he who can employ the best technical press agent may hope for most fame. Whereas he who actually possesses a talent for originality and invention without advertising ability would be soon forgotten except for patent protection. Engineers who hope for any material progress of the profession of civil engineering as a whole will do well to claim the rewards of the patent law. If one's greatest ambition is merely to stand high in the profession he can afford to ignore patents.

Civil engineers have always been zealous in maintaining their ownership in their own designs. The Engineering News of January 16th, 1913, contains an editorial explaining its refusal to publish a paper on flat slab construction because the engineer author refused to furnish complete details as to sizes of steel employed. The editor concludes that while "The rights in property are indisputable," nevertheless such secrecy is regrettable. If the improvement in the design of the steel could have been made the subject of a patent and thus made public to the profession for a royalty payment the progress of the profession in this particular line would not thus have been retarded.

A patent is not an injurious monopoly. It withdraws nothing from public use. It merely withholds for a limited time what otherwise might never have been acquired. It does not even withhold anything from the engineering profession, provided a uniform royalty is established for the patent.

For the engineer does not in any case pay the royalty. The owner or client who employs the engineer is the party that ultimately pays for the use of a patent. If engineers find it difficult to arrange for payment of royalties by their clients, that is the fault of the profession's relations with clients rather than of the patents, and low pay for engineers is at the bottom of it.

One feature of the concrete industry is beautiful in theory but, at the present time, bad in practice. That is that the construction of a concrete bridge is open to any incompetent, no matter what his previous lack of experience. Award at public letting must almost necessarily be to the lowest bidder. He who knows least is most apt to bid lowest. Some day engineers will become trained in design and contractors will have gained skill in erection and in cost analysis and these difficulties will vanish. But at the present time unsightly concrete bridges are built by unskilled contractors bidding below cost and not restrained by competent engineering supervision, and the result is always a reaction against all concrete bridges.

Until engineers and contractors do become trained in such erection, the patented concrete bridge offers a better solution. For the patents enable their owner to specialize in concrete bridges exclusively and thus improve methods of design, of letting, and of construction.

A reasonable method of letting for patented bridges is for the county engineer to place on file general plans showing externals only such as span, roadway and general architectural treatment desired, but accompanied by detailed specifications giving loading, allowable stresses, pressures on foundations, etc., and then requiring each bidder to submit his structural details complying with the general plans and detailed specifications and accompanied by a bond guaranteeing his design. By this method the untrained builder can be excluded, for he will be unable to secure plans that he will dare guarantee. And the contract can still be awarded to the lowest bidder. This method of letting was suggested for concrete bridges in an editorial in Engineering Record, January 22, 1910.

STORAGE BINS OF REINFORCED CONCRETE FOR RAW MATERIALS IN GLASS MANUFACTURE.

Experience has proved to manufacturers of some kinds of glass that certain of the raw materials cannot be advantageously stored in iron or steel tanks, owing to the resulting contamination of materials from rust, scale or whatever cause that results in iron particles becoming mixed with the stored materials. To prevent this possibility, the American Window Glass Company of Jeannette, Pa., has recently finished a battery of six reinforced concrete tanks. Five of these tanks are 26 feet inside diameter, and 35 feet high from the tank floors to the eaves of the conical roof. Three, which are of 19,700 cubic feet capacity, are used for storing sand; one for lime, and one for soda ash. The sixth tank, which is 14 feet inside diameter and 35 feet high, has a capacity of 5,000 cubic feet and is used to store salt cake.

An observation here will perhaps be interesting, namely, that concrete construction is to be used to store soda ash and salt cake. Frequently an attempt is made to support the contention that concrete construction is not suited to such purposes, yet here are many salt works using concrete tanks as grainers and for other similar purposes around salt manufacturing works, where it has been conclusively proved that if the concrete mixtures are properly proportioned and placed, then the concrete given required protection during the early hardening period, it has proved itself well adapted to such uses.

To return to the description of the tanks, they have 6-inch walls reinforced both vertically and horizontally with steel rods. They were built under specifications calling for 1:2:4 mixture. The floors of all of these tanks are flat except in the salt tank, there being in this one a false, hopper-shaped bottom in addition to the regular floor. The bottom was built in this way so that there might be no loss from deterioration of salt that would otherwise pack at the extreme edges of the floor and along tank walls, eventually forming a mass that would have a sloped surface toward the trap-door opening in the floor, corresponding to the angle of repose of the loose, dry material.

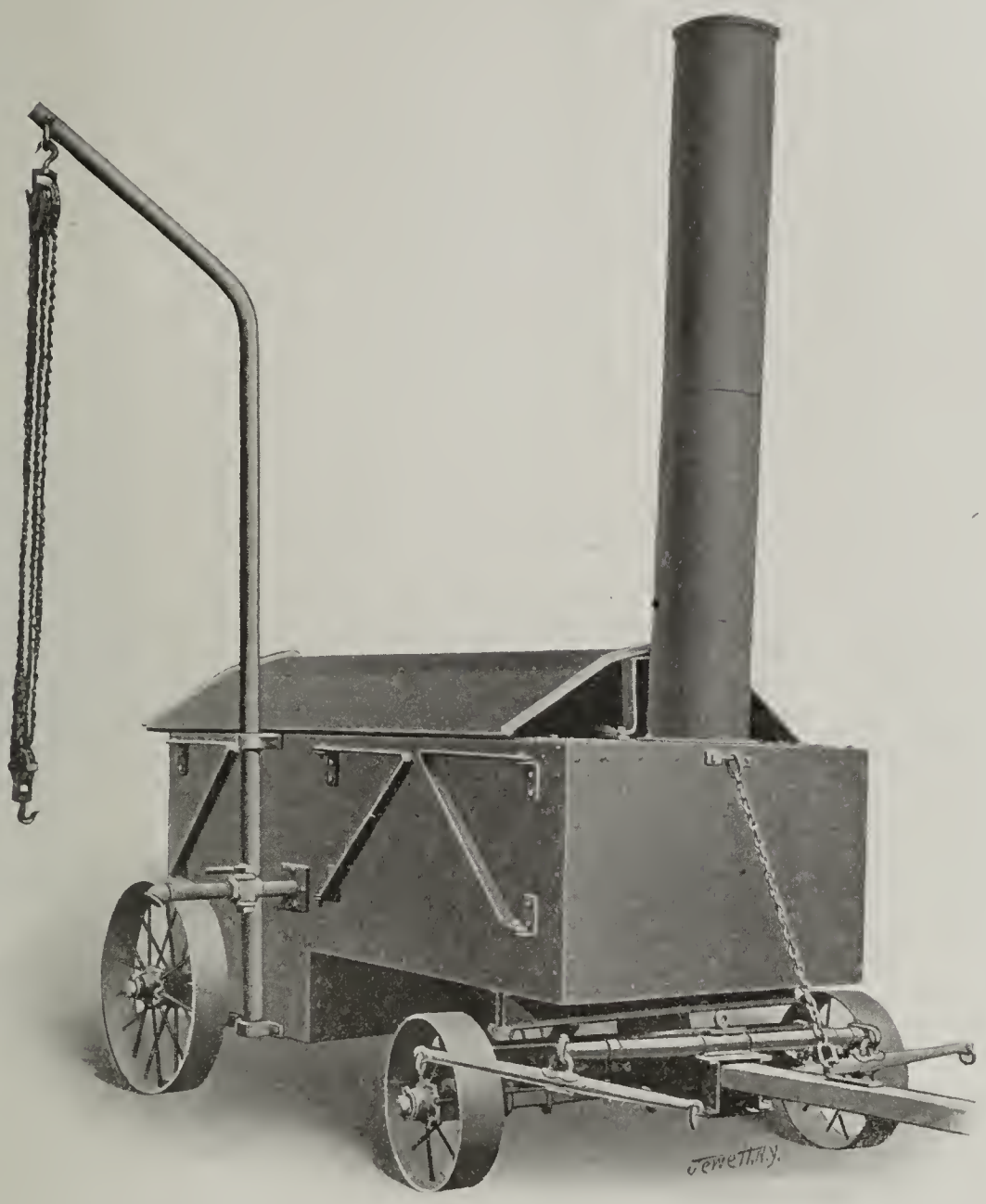
All of these tanks are set in a straight row over a concrete tunnel 9 feet 3 inches wide and 11 feet 6 inches high, inside dimensions. A car track is laid throughout the length of this tunnel to permit running a car under the tanks to receive material from them through trap doors in the roof of the tunnel or the bottom of each tank. This car carries a mixer and scales, the latter so that definite quantities of each of the stored materials can be weighed out to form each mix for melting. As the car travels forward the mixer revolves and finally discharges its content into a hopper at the end of the track, where the materials are conveyed to the furnace. The tanks rest on circular reinforced concrete mats 18 inches thick. Along the outer edges of these mats are the 15-inch foundation walls which support the tanks. All of these structures have

a conical wood roof covered with asbestos shingles.

A great deal of special conveying and handling machinery was planned and constructed especially for this plant. Cars arriving with raw materials are run on the track alongside of the tanks, the material being unloaded from cars by means of a power shovel similar to the types used for unloading grain. This shovel drags the material out of the car door and into a chute which is placed in position alongside of the car and slightly beneath the floor of the door. This chute carries the material to a bucket elevator. The elevator, which is about 45 feet high and runs on a track alongside of the bins, dumps material on a belt conveyor that runs over the bins and discharges into them at the apex of the roof.

Heating kettles are essential for such work. When tar only is used a less expensive kettle can be used than when asphalt must be heated, although tar can be heated in an asphalt kettle. The kettles are made in varying capacities from 150 gallons to 500 gallons. They are built of steel plate, well riveted and reinforced with angles. Although they can be purchased unmounted, most of them are made portable by being mounted on wheels and by having a handle so that a few men can move them from place to place on the street and road. If they have to be carried some distance by means of the handle, they are lashed to the rear axle of a wagon and hauled by the team.

Running lengthwise under the kettle is a fire box for heating purposes, cord wood being generally used for



400-Gallon Heater With Davit for Asphalt Contractors. Manufactured by Union Iron Works, Hoboken, N. J.

SMALL ASPHALT MACHINES.

In carrying on bituminous construction on both wagon roads and city streets, besides the mixing plants that have already been described in this series of articles, a contractor must use a number of small tools and machines, all of them being accessories for the class of construction. The writer has described the squeegee and top sand or pea stone distributer used in connection with bitulithic and Warrenite pavements. These tools and some others are used only upon patented .pavements for which the tools are licensed. Those to be described in this article can be used on any class of bituminous work.

the fire. On the best kettles there is placed on one side a davit. With this, a block and tackle and a pair of barrel grabs, barrels of tar can easily be raised to the top of the machine, where they rest on small iron rollers. These rollers facilitate the turning of the barrels so as to empty their contents into the heating kettle. The bottom of the heating kettle proper is round so as to provide increased heating area. The heated tar is drawn off through a pipe and faucet, although it can be dipped out of the kettle.

For smaller jobs, a combination tar and gravel or sand heater can also be obtained. This has two compartments, one for heating tar and another for gravel.

The standard size has a capacity of heating 70 gallons of tar and one ton of hot dry gravel per hour. The gravel is heated in an inclined oven so that it rotates when withdrawn. The wood burning fire box extends under both the tar kettle and the gravel heater and either may be heated separately if desired. It is so arranged that the hot ashes will not fall upon the street or road.

Portable heating kettles can also be mounted on a wagon gear. The kettle is underslung from the wagon body, placing it close to the ground. This type is intended for long hauls and short jobs. The tar can be heated while being hauled to the work. The wagon is also useful for carrying a tool box, and there is a sack provided for carrying pails, dippers, mops and other tools. Under the driver's seat is arranged a wood rack with a capacity of carrying two days' supply. The capacity of the tank may be either 100 or 150 gallons. This outfit is ideal for repairs and also for work where a stationary kettle would not be allowed to stand on the street. The wagon can be furnished either with shafts or pole.

Asphalt kettles are made in a number of different types and sizes. A round portable heater mounted on two wheels answers the purpose for small jobs and for patching. Another type is similar to the small tar heaters already described except that a top is provided. A larger size and type is mounted like a wagon, being divided into three compartments, allowing new or old asphaltic mixture to be heated as desired. On each side of the smoke stack two small removable kettles are provided for heating asphalt cement. The furnace is provided with cast iron grate bars.

The standard road builder's kettle has a capacity of 400 gallons, weighing 5,700 pounds. It is mounted on steel wheels and has a tongue and doubletree for two horses. The joints and reinforcing are made with heavy steel angles. The furnace is lined on four sides with cast iron liners, having air spaces; the grates and furnace door are of the steam boiler type. The tank is made of ¼-inch plate joined with heavy angles, hot riveted and caulked, and is provided with two 2-inch drawoff cocks connected by pipes to cast iron saddles arranged for easy cleaning. A steel cover is provided and an 8-foot stack. On each side of the kettle are swinging brackets to hold plank platforms for the workmen.

Either a 2½-inch pipe davit with a chain block or a barrel skid can be used to raise the barrels of asphalt.

For handling tar and asphalt a dipper and a pouring pot can be used. The dipper has a long wooden handle, two dipperfuls will fill a pot. An ordinary spout bucket or a watering can can be used, but these are both wasteful of tar or asphalt. The pouring can has a long sharply pointed spout that admits of pouring a thin stream if desired.

The Eldus hot asphalt and oil distributor is a small heating kettle of 50 gallon capacity with a fire box running the full length, keeping the material at the proper temperature until placed on the road. The asphalt or oil can be spread evenly at any desired rate by means of two levers and the distributor. There is also a drawoff cock at one end so that the contents can be taken out in pails without going through the distributing spout. The entire apparatus is mounted on two steel wheels with push cart handles and the two controlling levers immediately under them. The opening to the fire box is on the same end of the apparatus so the operator can attend to everything without changing his position. This machine is very valuable in building short stretches of road or for repair work.

Hand rollers must be used at times. These can be obtained weighing 1,000 pounds, and with long pipe handles that come in sections. From two to four men can operate these.

Heavy iron rams, rakes and forks for spreading the hot material, smoothing iron and finishing tools must also be used. These can all become foul with asphalt and to be cleaned must be heated. Some must also be kept heated in order to do efficient work with them. For this purpose a fire wagon is used. A wood fire is built in this. Underneath it is provided a sloping ash pan with a removable cast iron grate. Two uprights are provided with crossbars and hooks for holding melting pots. The other tools are laid in the wagon on the fire. The wagon is made of steel with ventilating holes in the sides and is mounted on steel wheels. The wagon can be drawn by hand or tied to another wagon.

These are among the principal small tools needed for this class of work. Those described in this article are manufactured by the Union Iron Works of Hoboken, N. J.

FREIGHT RATES ON SAND AND GRAVEL

Hearings in two cases involving complaints against alleged unjust rates on the transportation of lake sand and gravel were conducted in the federal building, Buffalo, N. Y., last week, by Wilbur La Roe, Jr., special examiner for the interstate commerce commission. The hearings were held as the result of complaints filed by the Queen City Sand and Supply Company of Buffalo, N. Y., and the Erie Sand and Gravel Company of Erie, Pa. Amicable adjustment, it developed, was reached due to the action of the railroad in agreeing to abandon the new and alleged excessive rate.

The complaints were directed against the New York Central Railroad. The Queen City Sand and Supply Company alleged that the Central had advanced its rate for the transportation of sand and gravel from Buffalo to Erie eight cents. The old rate was 68 cents and the new rate 76 cents per ton.

Henry Rice, head of the Queen City Sand and Supply Company, was present at the hearing and spoke in favor of the return to the old rate. He said that the proposed increase in the rate would be a blow to him because of the fact that he had contracted with large users of sand in Buffalo and that the contract extended over a year.

If the proposed rate was made effective, Mr. Rice explained, he would lose two cents on every ton. He said he had figured a profit of only six cents a ton under the old rate and that the increase of eight cents would leave him two cents to the bad.

The Erie concern alleged a rate discrimination in favor of common or river sand against lake sand and gravel. Protest was made against the proposed rate on lake sand and gravel of 71 cents from Erie to Youngstown, it being set forth that the rate on common sand and gravel from Erie to Youngstown is only 63 cents as compared with the other.

The treatment of concrete surfaces is receiving a great deal of attention, and various methods have been advanced for producing a surface which is smooth and, at the same time, does not present the expressionless effect of a smooth mortar surface. L. R. Ash, former city engineer of Kansas City, Mo., believes that specifications can most easily provide for the finish of concrete surfaces by requiring the bidders to tender on two or three different kinds of treatment at a stated price per unit of surface, leaving the engineer to choose that method which, in his opinion, most nearly suits the condition when the forms are removed. Of course, all specifications should require forms to be built of smooth lumber with tight joints and true to line.

Economic Efficiency—Motor Trucks for Road Work

The Transportation Problem Presents Two Outstanding Demands —Economy and Efficiency. To Both of These the Motor Truck Has Furnished the Answer.

Thousands of miles of roads are built in the United States each year and if motor trucks were used to do the hauling for this work the profits made by the contractors would be much larger than they are where horse trucks are used.

In such service as this motor trucks are given an opportunity to produce extraordinary results because the hauls are usually long, and as much of this work is done in rural districts, traffic obstructions are eliminated and the motor trucks can make their best speed.

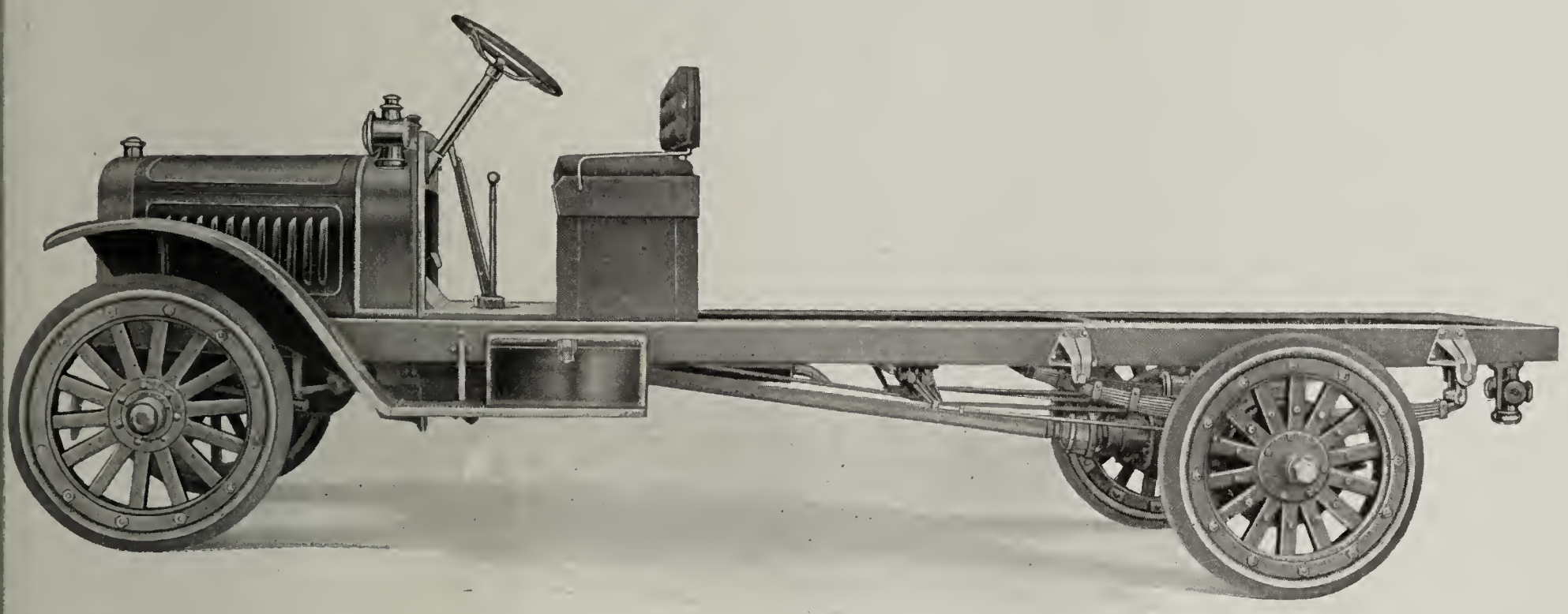
A contractor who began using motor trucks two or three years ago said that he initiated his trucks on a rural road building job, which took him six months to complete. He kept strict account of tonnage hauled by the motor trucks and the final cost figures showed at the end of that job, he says, that he could then have thrown his motor trucks in the river without any loss —that is, the cost of hauling the total tonnage of materials used on that job, with motor trucks, was enough less than it would have been if horse trucks were used, to cover the cost of the machines. You may be assured he did not throw the motor trucks in the river—they are still giving him good service and his experience has taught him the wisdom of substituting motor trucks for horse trucks wherever it is possible.

The Warren Brothers Company, Boston, Mass., engaged in road building, is particularly pleased with the service it is getting from two motor trucks, which are used for hauling prepared road materials. This material is made ready for use by heating, then it must be spread on the road before it becomes cool. Using horse trucks on work of this kind, the working radius from the heating plant is very limited, and it is necessary to be almost constantly changing the location of the plant. Since their motor trucks have been put into service the working radius from the heating plant is increased to three or four times what it was before. Motor trucks have effected an important reduction in hauling and labor cost for this company.

It is a well-known fact that the construction of permanent highways located away from supply sources, is limited to a great extent by the cost of hauling the materials needed to do the work. This applies with added force as the distance from the supply station increases; the point is finally reached when the cost of hauling materials makes further progress impracticable. When motor trucks are substituted for horse trucks and traction engines on such jobs, the work may be carried much farther before the cost of construction becomes prohibitive.

Motor Truck Transportation for Hauling to Isolated Jobs

The use of motor trucks for hauling materials to dams, pipe lines, irrigation projects, etc., located at great distances from the supply sources, offers some advantages in addition to those mentioned in the foregoing paragraphs. Traction engines are the most common carriers used at present to meet such conditions but it is only a question of a short time before this slow, costly method will give place to the more efficient and economical motor truck. One heavy service dump truck will haul almost as much tonnage per trip as a traction engine with its train of cars, and the motor truck will make several trips while the traction engine is making a single trip.



Two-Ton Internal Gear Drive Chassis. Republic Motor Truck Co., Alma, Mich.

On these very long hauls through isolated country it is necessary, if horse trucks are used, to establish relay stations every fifteen or twenty miles and the cost of hauling hay and grain to these stations is astounding. If traction engines are used, fuel and water stations must be established, which again adds great expense. If motor trucks were used on these jobs they would make several times the speed possible by either of the other methods; would require fewer men to handle them and could carry their own fuel for a round trip without reducing their regular load.

Around camp a motor truck has infinite uses for which traction engines would be of no value.

From these suggestions a contractor who will consider the proposition thoughtfully will realize the advantages which motor trucks offer his organization, more fully than they can be expressed in print.

The reasons that have been responsible for the introduction of so much labor and time-saving machinery into the contractors' working methods are just as pointedly in favor of the substitution of motor hauling for hauling by horses or traction engines—either of these last named methods is but a little more obsolete than the other.

All grades of draught horses are increasing tremendously in cost, likewise hay and grain have advanced in price, giving further reasons for the elimination of horses as commercial transportation factors.

Statistics show that the average period of working efficiency of horses bought by contractors for draught purposes is two years. A motor truck will give first-class service for several times this period, all of the time doing the work that it would require several horses to perform.

The contractor who uses motor trucks to replace horse trucks in his hauling equipment appreciates being relieved of the great care it is to keep a large number of horses in fit physical condition. Not being animate, motor trucks cannot be sick; they need no rest periods; their endurance is that of any other piece of strong machinery and they entail no mortality losses.

The Gramm-Bernstein Company, Lima, Ohio, and also the Standard Motor Truck Co., Detroit, Mich., fully appreciates the opportunity which awaits the manufacturer who will produce a motor truck which contractors will concede is practical for their use; accordingly their engineers have studied the problem thoroughly and after a long series of experiments they have produced a heavy service dump truck, with power-driven dumping device, that will greatly simplify the contractor's haulage problem.

ASSOCIATION OF CEMENT MANUFACTURERS

At the annual meeting of the Association of American Portland Cement Manufacturers, held in New York on December 15, 1915, the following officers were elected:

President, B. F. Affleck.
First vice-president, P. W. Kelley.
Second vice-president, Richard Hardy.
Assistant Secretary, L. R. Ferguson.
Treasurer, G. S. Brown.
Assistant Treasurer, John J. Matthes.

Percy H. Wilson, who has served as secretary for a number of years, resigned and J. P. Beck was elected general manager of the Association. The Association unanimously approved of a comprehensive plan for enlarging the activities of the organization submitted by Mr. Beck, and by resolution the Executive Committee was instructed to carry into operation the proposals in the report.

Mr. Affleck, the new president, is president of the Universal Portland Cement Company; Mr. Kelley is president of the Helderberg Cement Company, and Mr. Hardy and Mr. Brown are respectively presidents of the Dixie Portland Cement Company and Alpha Portland Cement Company. Mr. Ferguson has been connected with the association for some time as assistant secretary. Mr. John J. Matthes is treasurer of the Alpha Portland Cement Company.

LIME FOR SOIL

Beaver Portland Cement Company, Northwestern Bank building, Portland, is marketing considerable agricultural lime among the farmers of Willamette valley, Oregon, where the soil is deficient in lime, which is one of the ten essentials of plant food. This company has extensive deposits of lime and shale at Gold Hill, Oregon, where a force of men is now engaged in completing the company's cement manufacturing plant. Lime for agricultural purposes is being taken from those deposits. The company maintains a testing laboratory at this plant where soil tests are made as to acidity and deficiency in lime. The spreading of lime on some soils not only supplies an element of plant food, but neutralizes acids which have caused soils to sour; then lime is required to combine with other elements and to increase capillary action.

NEW APPARATUS DETERMINES FINENESS OF CEMENT

Three years experiments intended to produce a means of determining the exact fineness of cement have resulted, at the Bureau of Standards, in the developing of an apparatus which is effective for this purpose.

In the manufacture of Portland cement clay or shale and limestone are ground together and "burned" in rotary kilns. The cement comes from the kilns in the form of hard, black, semivitreous lumps, or "clinker." When pulverized this clinker becomes a grayish powder, which is the familiar article of commerce employed for a great variety of purposes in practically every type of building construction.

It has long been known that the fineness to which the cement is ground is one of its most important characteristics, and consequently specifications require that 75 per cent or more of commercial cement shall pass through a No. 200 sieve, which has 40,000 openings per square inch. This is the practical limit of mechanical sieves in respect to fineness.

It is very important to have some means of measuring directly the entire state of subdivision of cement; in other words, to discover just what percentage of the material is made up of particles of certain definite sizes. If such a division can be made, it should be possible not only to compare the efficiency of different grinders, but also to determine what degree of fineness must be attained before the cement becomes "hydraulically active"—that is, capable of combining with water to form the binding material in mortar and concrete.

The apparatus devised by the Bureau of Standards consists of a vertical brass pipe, about 3 inches in diameter and 5 feet long, at the lower end of which is attached a glass bulb in which the cement to be tested is placed. Air at constant pressure is blown into the cement through a glass tube or nozzle in the side of the bulb, and as the air can escape only through the vertical stack it carries with it the cement dust, which is caught in a flannel hood surmounting the stack. The air flow in the stack is very uniform, and in a short time all the dust will be removed from the cement, leaving a granular residue in the glass bulb. This residue is weighed and the amount of dust is determined by subtracting the weight of the residue from that of the original sample of cement. Different grades are obtained by using different sized nozzles, and thus a number of separations can be made in the very fine portion of the cement. With the aid of the microscope the size of the largest particles in any given separation can be readily determined, and in this manner the apparatus is standardized without reference to the size of the nozzles and other parts of the apparatus or the air pressure used.

It is found that the cement "flour"—that is, the portion of cement which contains no perceptible grit when rubbed between the fingers—consists of particles less than 0.0007 inch in diameter. The apparatus is called the air analyzer, and may be used for separating and grading any hard-grained materials, such as ground quartz, emery, and other abrasives. The air analyzer in modified form is also capable of separating many other powders, for example, paint pigments, plasters.

Cement Production Unprecedented

For This Time of the Year. Huron Portland Cement Company Will Run Their Mill All Through the Winter for the First Time in Its History. Wabash and Other Cement Companies Installing New Kilns, Crushers, Pulverizers, etc.

The Huron Portland Cement Company, Alpena, Mich., will at once break ground for a new building of concrete. It will be 267 feet long by 125 feet wide and will house eight departments of the big plant which now occupy various smaller buildings.

The big plant will be run all through the coming winter for the first time in its history. This means much to the several hundred employes of the company and to the city in general. In previous years, a shut down of some length has been customary.

The departments which will be housed in the new building are the office, laboratory, machine shop, sheet iron shop, carpenter shop, storage department and electrical department.

Most of these departments now are in separate buildings, lying beyond the main plant. It is expected that the placing of the various departments in closer communication in the new building will considerably increase the efficiency of the plant.

The new buildings will be two stories in height, with a basement. The roof will be of steel.

William P. Harris, manager of the company, said:

"All the space which now forms the sites of the various departments which will go into the new plant, will be available for use for clinker storage, upon the completion of the new building.

"The advantage of this is that it will be possible to turn all clinker out of the cement plant onto the open ground for seasoning. This seasoning makes the grinding of the clinker very much easier; so much so that it is believed that 20 per cent more clinker may be ground in a given time than is ground in the same time now. Indirectly, this will open the way to an increase of the output of the plant.

"Without this clinker storage space it is now necessary to cool the clinker artificially before it is put in the grinders. This is expensive and slower than the new method will be. Patent coolers are used and water is turned on the unfinished product.

"There will be the expense of carrying about 150,000 barrels of clinker on hand, seasoning all the time," said Manager Harris, "but I do not believe that expense will be as heavy as is that of the present artificial cooling process. And with this artificial cooling, the clinker is not as well seasoned and as adaptable for grinding as it will be under the new method."

The advantage of running the big plant all winter is that it will keep the company's organization intact, the year round, and it will make the going more even. In former years, when the winter shut-down has been in effect, it has been necessary to crowd the plant to the limit to get out the products demanded during the balance of the year. Under the all-year plant practically the same pace will be kept all the year, a big stock pile being accumulated during the winter months, ready for the opening of navigation.

EDISON CEMENT PLANT IS TO OPEN SOON

The Edison Cement Company is planning to resume operations by January at the big plant at Stewartsville, N. J. The plant has been idle for some time.

Since last July only the watchmen, office force and fewer than a dozen other men have been kept at work. When the plant closed 600 men were on the day shift and about half that number on the night shift, the plant being kept in continual operation, including Sundays. The shutdown was due to the low price of cement.

The company is now seeking machinists to make some necessary repairs and get the plant ready to resume manufacturing operations.

There is said to be about sixty feet of water in the quarries and this will be pumped out within the next week or two. When the plant was shut down it threw about 200 men out of employment in the vicinity of Oxford, where one of the limestone quarries is located.

LEHIGH CEMENT PLANT AT NEWCASTLE RESUMES

Plant No. 2 of the Lehigh Portland Cement Company at Newcastle, Pa., resumed operations in full last week after three months idleness and 250 employes returned to work. With the resumption of the plant the company announced that all employes would receive an advance in wages averaging 12 per cent.

MARQUETTE CEMENT COMPANY ENLARGING THEIR PLANT

The Marquette Cement Manufacturing Company has let contracts for considerable enlargement of its plant in the way of new furnaces, grinding machinery and generators, indicating a faith in the future.

At a special meeting of the stockholders the directors were authorized to increase the capital stock to $3,000,000, taking such amount as necessary from the surplus account. The capital previously authorized and outstanding was $700,000. The balance sheet of January 1, 1915, showed surplus and undivided profits of $2,109,688.

LEHIGH CEMENT REGION

Cement production in the Lehigh region continues upon an almost unprecedented tonnage for this time of the year with little prospect of any early material decrease. Several of the mills have been shut down temporarily during which repairs are being made, although they are kept in shape for immediate resumption should the demand for cement necessitate.

NEW GENERAL SUPERINTENDENT FOR ATLAS CEMENT MILLS

A. Gilbert Croll, Allentown, Pa., formerly assistant general superintendent of the Atlas Portland cement mills, located at Northampton, Pa., Hudson, N. Y., and Hannibal, Mo., has been appointed general superintendent of the Atlas company, with offices at 30 Broad street, New York City. He succeeds H. J. Seaman, of Catasauqua, who has been superintendent since the organization of the company, and who recently resigned on account of ill health. The advancement of Mr. Croll is certainly merited. His first position with the company was that of a draughtsman about fifteen years ago, and by dint of hard labor he has risen to his present position. He is a graduate of Cornell University and is a recognized authority on engineering problems.

Clinchfield Portland Cement Corporation

Doubling Capacity of Its Plant. Latest Developments in the Methods of Crushing and Handling Cement. Sales Manager Has His Headquarters at Plant to Give Direct Personal Attention to Orders and See That They Are Handled with Facility.

A striking instance of the success of a Southern manufacturing industry started four years ago, as well as the faith of its officials in the future demand for its products, are reflected in the work now under way, doubling the capacity of the plant of the Clinchfield Portland Cement Corporation, Kingsport, Tenn., and the increase of its capital stock from $1,500,000 to $2,000,000 to take care of this expansion.

This plant was built with an initial capacity of 2500 barrels per day, so that the increase will give it 5000 barrels daily, and this added output is expected to be ready for the market by the spring of 1916.

Hunter, formerly with the Edison Portland Cement Co., in order to develop and broaden the demand for Clinchfield cement in this new market.

Incidentally, the company's business in the Carolinas grew so steadily in recent years that a branch sales office in this district was opened last year at 908 Commercial Bank Building, Charlotte, N. C., in charge of John A. Hudson. In addition to these offices, the sales department also has traveling representatives covering other parts of its territory. All of these selling departments report direct to W. E. Law, the sales manager of the company, who has his headquarters at the plant

General View, Clinchfield Portland Cement Plant, Including Recent Improvements. The Following New Equipment Is Being Installed: Three No. 6 Universal Mills and One No. 3 Vulcanite Mill, Williams Patent Crusher and Pulverizer Co., Chicago and St. Louis; two Allis-Chalmers Kilns; Five No. 2 Duplex Sturtevant Ring-Roll Mills; Six Giant Griffin Mills, Bradley Pulverizer Co., Boston.

This was one of the big industries that was established along the line of the Carolina, Clinchfield & Ohio Railway in Eastern Tennessee a few years after this railroad opened up this undeveloped territory, which contains such a wide variety of mineral, timber, agricultural, water-power and other resources. Marked success has followed the operation of the plant and the marketing of Clinchfield Portland, which has been due not only to the high quality of material made, but also to the good shipping facilities the Clinchfield Railway provides into very active sections of the South. Direct shipments are available over the Appalachian Mountains into the Carolinas, where connections are made with the leading Southern railroads, enabling Clinchfield cement to be placed in the important markets of the Southeast. At Johnson City, Tenn., connection is also made with the Southern Railway, which gives north and south distribution in this territory, and farther up on the Northern end connection is also made with the Norfolk & Western and Louisville & Nashville, thus enabling the company to handle cement orders over a wide area. Just recently the Carolina, Clinchfield & Ohio Railway completed its northern extension to Elkhorn, Ky., where direct connection is made with the Chesapeake & Ohio, giving a direct route to Cincinnati and Southern Ohio points, including Kentucky and Western West Virginia. A branch sales office was recently established at 1305 Union Trust Building, Cincinnati, O., in charge of Morris M. at Kingsport, Tenn. The successful marketing of Clinchfield cement has been due in a large measure to the efficient selling organization which Mr. Law has developed, and by having his own office at the plant he is able to give his direct personal attention to orders that are received and see that they are handled with facility.

John A. Miller, the president of the company, actively directs its affairs. He is a man of wide experience in the manufacture of Portland cement, having for many years been vice-president of the Dexter Portland Cement Company of Nazareth, Pa., and in recent years the president of that company. When the Clinchfield plant was established at Kingsport under his direction, his knowledge of cement manufacture enabled him to gather about him men of wide experience and knowledge of the business, and the efficient organization established and conducted under his administration has proven an influential factor in the success the company has achieved. Other officers of the company include H. R. Dennis, vice-president, New York city; W. M. Bennett, second vice-president and treasurer, Kingsport, Tenn., and E. G. Woodling, secretary, New York city.

When the original plant was built this was so designed and laid out to allow extensions to be made when they would be needed; consequently, the construction work necessary to provide the additional out-

put only requires the building of certain foundations and adding units to the different parts of the plant.

The accompanying illustrations give some good ideas of the plant as it looks today, and also show the new power-house, the clinker storage yard, the foundation walls of the new stockhouse and some of the foundations for the new finishing mill. As will be noted, this construction work is substantial in every character. The big stack for the power-house is of reinforced concrete construction, and is 207 feet high. The following list covers the principal equipment that is being installed to provide for the increased capacity:

Three No. 6 Universal mills and one No. 3 Vulcanite mill, Williams Patent Crusher & Pulverizer Co., Chicago, Ill.

Six 7 x 22 mills, Bethlehem Foundry & Machine Co., South Bethlehem, Pa.

Two 8 x 125 rotary kilns, Allis-Chalmers Company, Milwaukee, Wis.

Five No. 2 Duplex Sturtevant ring-roll mills, Sturtevant Mill Co., Boston, Mass.

Three Giant Griffin mills for the coalhouse, Bradley Pulverizer Co., Boston, Mass.

One rotary cooler, two rotary dryers.

Fifteen-ton locomotive crane.

One-hundred-ton railroad track scales.

Stone-handling and elevating machinery for stone storage.

Structural steel for building purposes, Belmont Iron Works, Philadelphia, Pa.

Structural steel, boiler-house, Virginia Bridge & Iron Co., Roanoke, Va.

Excavation and concrete work, Oliver & Hill, Maryville, Tenn.

Electrical machinery, includes one 2500-kilowatt alternating-current generator.

Four 350-horse-power boilers.

Eight stokers, Detroit Stoker Co.

Coal and ash-handling equipment, Shepherd Electric Crane & Hoist Co., Montour Falls, N. Y.

Reinforced concrete chimney, Weber Chimney Co., Chicago, Ill.

Boiler-feed pumps, Hy. R. Worthington, New York city.

2500-horse-power feed-water heater.

50,000-gallon steel tank for fire protection, R. D. Cole Manufacturing Co., Newman, Ga.

1500-gallon Underwriter fire pump, Deane Steam Pump Co., New York city.

300-gallon deep-well pump.

High-pressure steam piping, Walworth Manufacturing Co., Boston, Mass.

The enlargement of the plant comes under the supervision of the company's general superintendent, L. L. Griffiths. Such machinery that had been tested for efficiency or found to best suit the new installation was purchased, thereby balancing the mill, with the assurance from experience that the new installations being made will prove economical and successful in the manufacture of Clinchfield Portland cement.

The company has also recently constructed a number of splendid houses for those officials who make their headquarters at the plant. These houses are modern in every feature and design and construction, and contain all appliances that make for the comfort of the occupants.

The completion of the extensions under way will make this the largest plant making Portland cement in the South, and great credit is due those who have developed this industry in four years to its present successful operation. It is a striking illustration of what can be accomplished through proper financing and a well-directed efficient organization.

CALIFORNIA PORTLAND CEMENT COMPANY HOST TO 3,600 PEOPLE. LARGE AMOUNT RECENTLY SPENT IN IMPROVEMENTS

The California Portland Cement Company, Colton, Calif., was host to 3,600 people who inspected the works and shared in the greatest open-air barbecue known to San Bernardino valley. T. J. Fleming, general manager, whose energy and faith in the prosperity of the Pacific coast were factors in the building of the giant plant, arranged the occasion.

The plant employs 600 persons and makes a sack of cement every two seconds. Eight thousand tons of rock are crushed daily and the company recently expended more than $1,000,000 in enlarging its plant and installing a giant rock crusher. By the installation of a device invented by Mr. Fleming the cement dust nuisance, which promised to be a fruitful source of litigation, was done away with.

Employes of the plant escorted the visitors through the many buildings and explained every detail. Leading business men were present from all parts of the San Bernardino valley and from Los Angeles, Pasadena and other cities.

CRUSHED STONE OUTPUT OF PIEDMONT PORTLAND CEMENT COMPANY TO BE GREATLY INCREASED

Principally for supplying commercial crushed stone in larger quantities, the Piedmont Portland Cement Company of Atlanta, Ga., is enlarging the capacity of its plant at Portland, Ga., to 800 tons daily. A crusher and supplementary equipment are being installed, and the company will be able to furnish this large amount of crushed stone in all screen sizes daily. It is arranging to operate the plant with electricity, which will be secured from the Georgia Railway & Power Company, and is making a number of other important improvements at its quarry.

The Piedmont Portland Cement Company is selling large quantities of high-grade crushed stone. It furnishes a hard, blue limestone in any size and quantity, absolutely clean and accurately screened. For asphalt paving, it furnishes pulverized limestone in bags or in bulk. Deliveries are guaranteed.

In 1912 the company began, as an experiment, to sell pulverized limestone for agricultural purposes, and each year since that time there has been a large increase in its sales. It has shipped limestone into practically every agricultural county in Georgia and in addition does an extensive business with fertilizer manufacturers. For three seasons it has shipped pulverized limestone to the 22 plants of the Southern Cotton Oil Company and to all the plants of the Virginia-Carolina Company, which buys in 1,000-ton lots.

The great benefits that result from the use of limestone for agricultural purposes have been conclusively demonstrated, both as to mechanical effectiveness and as a plant food. Because of the cutting off of the supply of potash from Germany, the use of limestone on land has become especially desirable and valuable. It makes available the substantial percentage of potash that exists in most Georgia soils.

From practically nothing in 1912, the use of limestone in Georgia has grown to 75,000 tons or more this year.

The Piedmont Portland Cement Company is particularly well prepared to furnish pulverized limestone for agricultural purposes and crushed stone of a hard character for other uses, for the reason that it devotes a well-equipped cement mill to supplying them and does not make this a side issue.

NEW OFFICERS FOR LEHIGH PORTLAND

At a meeting of the board of directors of the Lehigh Portland Cement Company, John D. Ormrod was elected a member of the board to succeed his father, the late George Ormrod. A. Y. Gowen, of Chicago, who was formerly third vice-president of the company, was elected second vice-president, to succeed the late Mr. Ormrod.

At the same time Daniel E. Ritter, of Allentown, Pa., was elected third vice-president, succeeding Mr. Gowen. Mr. Ritter was formerly assistant to the president, Col. Harry C. Trexler.

The present board of directors consists of Col. Harry C. Trexler and Col. E. M. Young, Allentown; George K. Mosser, Trexlertown; A. Y. Gowen, Chicago, and John D. Ormrod, Emaus.

Mr. Ritter's promotion, which is a well merited one, comes as a recognition of his valuable services to the company. Joining the Lehigh upon its organization in 1897, Mr. Ritter rose step by step, holding many important positions of an executive as well as a managing capacity during his term of service.

COMPLETE BUILDING SHOW AT CLEVELAND

An architectural competition of the most practical kind will be held in connection with the First American Complete Building Show, in Cleveland, O., Feb. 16 to 26, under the direction of the Cleveland Chapter A. I. A., in co-operation with the Chamber of Commerce, Cleveland Art Association, Builders' Exchange, Society Advocating Fire Elimination and other civic bodies.

The competition is for a workingman's home to cost not more than $3,000 complete, exclusive of land and embellishments. There are seven prizes, the first being $200. The contest is open to all materials.

Rules of the competition call for six rooms, with basement under entire house. It is the aim of the committee to obtain designs that are in every way practical; and awards will be made upon this basis.

All drawings must be in by February 1st.

Instructions regarding the contest may be had by applying to The Complete Building Show Company, 356 Leader-News Bldg., Cleveland, O.

WHITE WATERPROOFED CEMENT

The Sandusky Portland Cement Company has just issued from its main office at Cleveland, Ohio, a handsome catalog on "Medusa White Waterproofed Portland Cement."

This white waterproofed cement has been manufactured by this company to overcome the objection which is sometimes raised among architects and engineers that waterproofing material is not properly mixed and proportioned with the cement. They sometimes hesitate to specify waterproofing material of any kind on this account, although realizing its value in the finished product.

To overcome this object Medusa waterproofing is now being ground with Medusa white Portland cement in the process of manufacturing in the proportion of 6 pounds of waterproofing to each barrel of cement. The fact that this mixture and proportioning is done right at the mill by the manufacturers insures its correctness, so that architects and engineers need have no hesitancy in specifying it.

The catalog which is just out tells what this product is, and gives specifications for its use, together with suggestions as to a number of different things for which it can be used; and also gives a large number of illustrations of residences and other structures which have been finished with Medusa waterproofed white Portland cement. Altogether it is a most attractive piece of work and is well worth sending for.

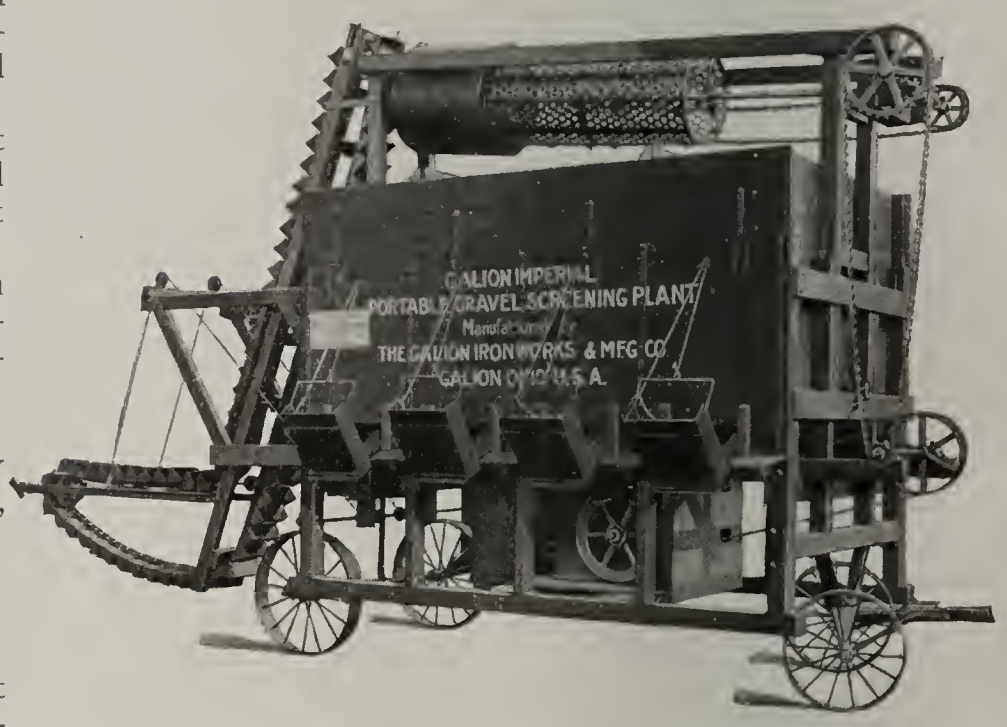
GRAVEL SCREENING PLANT

A gravel screening plant which has recently been put on the market is shown in the accompanying illustration.

The plant consists of an elevator, screen and bin, mounted on four wheels, together with a gasoline engine for operating the machinery. The outfit is 14 ft. long, 9 ft. wide and 10 ft. 7 ins. in height, the frame and bin being built of timber.

The bin has a capacity of 20 tons and is divided into four compartments, each of which is equipped with a wagon loading chute on each side. The revolving screen, mounted at the top, is 30 ins. in diameter and 9 ft. long and is divided into three sections, with ½-in., ¾-in. and 2-in. perforations, respectively. It is also equipped with a removable dust jacket or sand screen. Sections with special performations are furnished when desired. The elevator is 20 ft. long, center to center, the lower part being hinged so that it can be raised or lowered as desired. The buckets are 14 by 8 by 6 ins. in size.

The engine is a 6 HP. Blue Line, hopper-cooled, gasoline engine and is housed directly under the bin. The elevator and screen are driven by chain and



Galion Imperial Portable Gravel Screening Plant.

sprocket gears from the countershaft at the front end of the plant, as shown in the illustration.

When the plant is set up, a hole about 5 ft. deep, 3 ft. wide and 6 ft. long is dug as a pit for the boot of the elevator. A steel hopper chute with a steel gate at the mouth of the chute is furnished with the plant, and this is so placed that the mouth of the hopper projects into the pit over the boot of the elevator. The upper end of the hopper is covered with a plank platform with a suitable opening through which the gravel can be dumped into the hopper from drag or wheel scrapers or other carriers.

The working capacity of the plant is given as 25 to 30 cu. ft. per minute or 50 to 60 cu. yds. per working hour under ordinary working conditions. It is known as the Galion Imperial portable screening plant, and is made by the Galion Iron Works & Mfg. Co., of Galion, Ohio.

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10 FT "LINCOLN HIGHWAY" TYPE
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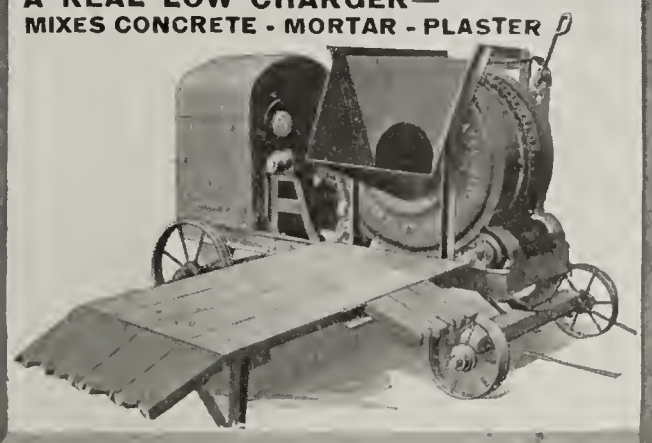
MIXES CONCRETE - MORTAR - PLASTER



JEFFREY ELECTRIC HAULAGE LOCOMOTIVE

The 7-ton Electric Locomotive illustrated on this page was installed by J. H. Miller at Lewistown, Pa., to haul sand from his mine to the storage pile, a distance of about one mile.

The sand is loaded in the mine into drop bottom cars, which have a capacity of 3½ tons, and hauled by the locomotive to the trestle over the storage ground.

View Showing Locomotive Hauling Train of Cars.

The trolley stand on this locomotive is of special construction, being arranged with a hinged joint about 18 inches above the top of the locomotive frame, which permits the trolley mechanism and stand to be lowered when entering the mine.

View Showing Locomotive and Cars on the Trestle in Readiness to Unload, at the Plant of J. H. Miller Sand Co., Lewistown, Pa.

This locomotive is equipped with a 7½ H. P. crab device, the drum of which contains 350 ft. of ⅜ inch flexible steel rope.

The motor equipment consists of two 35 H. P. 500 volt motors. The rated draw bar pull is 3,500 lbs. with a starting draw bar pull of 4,200 to 4,500 lbs.

The dimensions are: Gauge 44 inches, overall width 54 inches. Length over bumpers 12 feet 10 inches, height over frame 30 inches. The Jeffrey Mfg. Co., 914 N. Fourth street, Columbus, O., will gladly furnish prices and information concerning their electric haulage locomotives.

SAND COMPANY TO BE RESTRAINED FROM REMOVING MATERIAL FROM RIVER

Suits against the Clegg Sand Company and the Juergens Sand Company, both Little Rock concerns, to compel them to pay for sand and gravel taken from the bed of the Arkansas river since March 11, 1915, were filed in Chancery Court yesterday by Wallace Davis, attorney general. The complaints ask that both companies be enjoined from operating their plants until the cases are settled and that they be compelled to bring into court an itemized statement of the cubic yards of sand and gravel taken from the river since March 11. The attorney general asks judgment for 5 cents per cubic yard for sand or gravel removed.

The suits are based on Act No. 138, passed by the last legislature. This act provides that no individual or company shall take sand or gravel from the beds of navigable streams for commercial purposes without obtaining the consent of the attorney general and agreeing in writing to furnish the attorney general a monthly itemized statement of the cubic yards removed and to pay 5 cents a cubic yard.

The complaints state that no statements have been filed and that the companies have not secured permission to remove sand or gravel. In a similar case the Arkansas Supreme Court recently decided in favor of the state.

1916 CONVENTION AMERICAN ROAD BUILDERS' ASSOCIATION

The date for holding the next or thirteenth annual convention of the American Road Builders' Association has been changed from the week of February 22 to the week of February 28, 1916, the closing day being March 3.

This meeting, which will be the only one of the American Road Builders' Association in 1916, will be the thirteenth annual convention of the Association. It will also be the sixth American Good Roads Congess to be held under its auspices, and will include also the seventh National Good Roads Show of machinery and materials. This show or exhibition will be held in Mechanical Hall, while the sessions of the Congress will be held adjoining. The Congress will commence on Monday evening, February 28, with the formal opening of the show, and will end on Friday, March 3, the technical sessions commencing on Tuesday morning, February 29, and continuing on Wednesday, Thursday and Friday.

The change in date has been made after careful consideration by the Executive Committee for several reasons, one of them being to allow more time for putting Mechanical Hall into proper condition. In order to make the repairs and changes necessary for the purposes of the convention, the City Council recently appropriated $15,000. The work to be done will include the installation of a heating plant, and the placing of a concrete floor. The building, which is owned by the city, is situated in the "Point" district, at the junction of the Allegheny and Monongahela Rivers, and faces on Duqusne Way. Direct railroad connections will facilitate the handling of heavy exhibits, and the location of the building in the downtown business district makes it an especially desirable meeting place.

Drain Tile Finds a Ready Market

Cement tile sells rapidly in every community where drain tile is used—or **should** be used. Equip yourself to **take orders.** Cement tile heads the list on **quality;** has no competition to fear on **price,** and can be **made at less cost** than any clay tile. As a business for small-town contractors it has no equal—we can **prove** it will pay 30% to 50% profit on even a small investment.

$165

Makes the strongest and highest quality cement tile ever produced. Easy and simple to operate, and makes all sizes of tile up to 12 inches diameter. Has triple-duty packer head, waist-high table, etc. The logical machine for beginners. Sold on 15 days' trial. Ask for Dunn Tile Machine catalog.

Dunn Machines Keep the Investment Down

Write us for interesting data (free) on the tile business—ask us about manufacturing costs, selling prices, profits, establishing local markets, and other valuable information. Investigate how we start you on the right road to a big tile business.

Success is a matter of equipment. You **cannot** make money if you spend a fortune on machinery—nor if you buy a "toy." The **one** tile machine with a **big** capacity (1,500 to 2,000 tile daily), and selling at a **small** price, is the DUNN No. 1.

DUNN MIXERS
For Men Who Know *Value*

The only mixer with **Power Discharge.** Made in two sizes, of 3½ and 5 cu. ft. capacity, mounted on skids or trucks. Equipped with Dunn Heavy Oil Engine or gasoline engines. Rapid and easy operating; real labor savers, and employ the **most efficient mixing principle** ever devised. Durably constructed of all steel and iron; rigidly guaranteed. Sold on **15 days' trial.** Write for mixer catalog.

$67.50 to $224

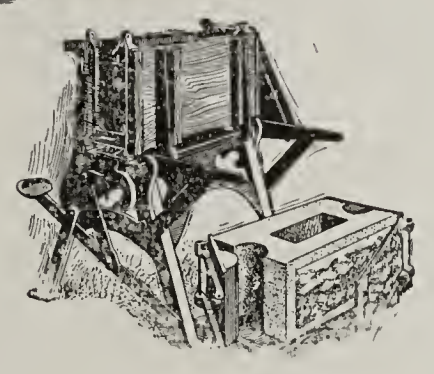
Pat's Nos. 842262 and 782700

Dunn Post Molds

Make four or ten reinforced concrete fence posts at a time. Assure a higher quality post at a lower cost of manufacture. Prices of 4-mold battery, $12.50, other prices in post mold catalog—get a copy. All molds sold on 15 days' trial.

Dunn Vase Molds

Price **$15.00.** Makes the artistic vases as shown (which retail at $8.00) for $1.50. Other Dunn molds for making concrete porches, chimneys, posts, piers, flower boxes, etc., completely described in Ornamental mold catalog, get a copy. All molds sold on **15 days' trial.**



Dunn Block Machine

Instantly adjustable for making Side Face, Face Down, or Two-Piece Wall blocks. Special off-bearing system prevents damage to wet blocks. Use a wet mixture and require little tamping. Capacity, 150 blocks daily. Sold on **15 days' trial.** Price.... **$40**

Satisfaction First, Last and Always

is what we have given customers since we started business. We ship any of our machines or molds on 15 days' trial so that satisfaction is predetermined before we receive a cent. You "play safe" when you buy from Dunn.

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To Manufacture Electric Steel Castings

This Company Has the Advantage of Unusual Experience in the Matter of Heat Treatment of Steel. Will Confine Itself to Small Castings of Superior Quality.

The organization of the Electric Steel Company marks a new and radical development in the steel castings industry of Chicago. At the present time the only electric furnace in Chicago is of the Heroult type and melts steel for large castings. The other jobbing steel foundries all operate converters. The Electric Steel Company will operate a Snyder electric furnace and will confine itself to small castings of superior quality, especially in alloy steel castings.

The officers of the Electric Steel Company are: Mr. Charles Piez, president, and Mr. P. L. Coonley, secretary and treasurer, who are respectively president and vice-president of the Link-Belt Company, at whose 39th Street plant in this city they have operated a Zanzes steel converter for a number of years. The active management of the new company will be in the hands of Mr. John M. Olmsted as vice-president, who has been a member of the sales force of the Link-Belt Company. These three, with Mr. W. C. Frye and Mr. C. R. Messinger of Milwaukee, constitute the board of directors. Mr. Frye is the financial head of the Sivyer Steel Casting Company, the Federal Malleable Company and other successful corporations of Milwaukee, while Mr. Messinger is vice-president and in active control of the Sivyer Steel Casting Company, which has for years enjoyed an enviable reputation for the high standard of its product.

The successful operation of the Electric Steel Company from its inception seems assured by the success these men have already attained in parallel lines. That this impression is generally held is proven by the fact that though deliveries of castings will not come until February 15th or March 1st, a large proportion of the company's output is already contracted for.

In order to commence operation with the least possible delay and to offer quick delivery, the company has leased a plant at 31st and Wood Streets, in the heart of the central district, formerly occupied by the Wildman Boiler Works, thereby eliminating the delays incidental to the erection of new buildings. This location, with a switch off the main line of the Chicago & Alton inside the Chicago Junction Railway, affords exceedingly good facilities for quick service either by truck or rail.

Power is supplied by the Commonwealth Edison Company from their high tension lines underground, thereby insuring the least possibility of interruption.

This company has the advantage of unusual experience in the matter of heat treatment of steel, the experimental study of which has proven to be of vital importance in the successful making of that class of high grade light weight castings which the requirements of the past few years have developed. There are many parts for accurate work and strong duty which cannot be successfully made in forgings. To take care of these requirements is the primary interest of this new company. Its process and practice, coupled with the experience and judgment of the men interested, will command the consideration of those firms who require thoroughly high grade steel castings.

CONKLIN SILO FORMS

The Conklin Construction Co., 430 W. Main street, Hartford, Mich., manufacturers of the Conklin monolithic equipment, which is very desirable for silo construction and may be used for many other purposes in concrete work, has just issued a new catalog, which they will gladly send to any of our readers. The catalog explains in detail the many advantages of the Conklin equipment. We want to direct your attention to a few very important points that will bear repeating, and should have your careful attention at this time, writes Mr. Conklin.

First, our equipment is built very strong, which is a great advantage to the contractor. It carries its own scaffolding, is automatically raised by the two jacks on the center mast. The silo may be built any height or diameter by using the proper size moulds, and will not vary from a true circle, even thickness of wall or a true perpendicular. Continuous and non-continuous doorway and concrete chute.

Second, you may build 8 feet per day with four men, or 64 feet of silo wall in 8 days. You will admit that this is rapid work, and will add to your profit.

Third, an important feature has to do with water tank construction on top of the silo, which can be done with the Conklin silo equipment. You will admit that farmers need a water supply. Water in the barn, for live stock and poultry, in the house that the modern conveniences may there be enjoyed, as a fire protection, not only a comfort and satisfaction, but enables you to reduce the insurance rate.

16x52-Foot Silo on J. Gus Peterson Farm, Marquette, Kan. J. F. Baugher, Contractor, Hutchinson, Kan. Getting Ready to Pour the Last Ring of This Job. Conklin Forms Used.

Milwaukee Street Concrete Bridge, Janesville, Wis.

Reinforced Concrete Bridge, Janesville, Wis.

A Four Span Reinforced Concrete Arch Structure, Fifty-four Feet Wide, Built on Principal Business Street of Janesville. Total Cost, Including Lighting System., etc., $36,535.

BY C. V. KERCH, CITY ENGINEER.

The Milwaukee Street Bridge, Janesville, Wisconsin, was erected for the city of Janesville under a contract with the Gould Construction Company, of Davenport, Iowa. It is a four-span reinforced concrete arch structure, fifty-four feet wide, built across Rock River on the principal business street of the city and connecting the centers of the business district on each side of the river.

It was built to replace an old pile bridge constructed in 1867; this replaced an earlier four-span wooden arch truss supported on stone abutments and timber crib piers of which the abutments and submerged portions of the crib piers still existed and occasioned some trouble in the construction of the footings for the new bridge.

Rock River, at this point, has a very uniform flow, with no sudden increase in flood elevations and with seldom any ice running in the Spring freshets, owing to the numerous springs and spring-fed lakes discharging into it, and because of its passing through Lake Koshkonong twelve miles above, with two dams between. This lake is a widening of the river with a superficial area of about twenty-three square miles, and acts as a natural storage reservoir.

The riparian owners adjacent to the bridge had taken advantage of the mild disposition of the stream to encroach on its banks, and had erected business blocks supported on pile substructures adjacent to the bridge for its entire length on the south side and for one-half its length on the north side.

The old pile bridge had been repaired and parts renewed from time to time so that it was in a fair state of preservation; the city was about to redeck it with a creosoted block paving and floor system when a fire on the first day of April, 1913, completely destroyed the two-story business blocks adjacent to the south side for about three-fourths of its length and so badly burned the old bridge that its rehabilitation was abandoned and a new structure authorized. The north half of the old bridge was placed in temporary repair by the city in conjunction with the Janesville Traction Company, which operates a street car line over it.

Plans for the new bridge were prepared by C. V. Kerch, city engineer, and the work carried to completion under his supervision. The encroachment on the west bank of the river by permanent retaining walls which had been fixed by the city at established boundary lines to prevent further encroachments on the river, permitted the new structure to be shortened without any contraction of the channel.

A four-span structure was determined upon as best fitted to allow its pier line to conform to the lines of

the remaining buildings and allow the footings of new buildings to conform therewith in case the burned buildings were rebuilt, of which there was some question as to the city's ability to prevent.

The bridge is located between two dams within the city with a considerable depth of water. The head of the stream is composed of glacial drift gravel and sand. As the gravel is water bearing, with a head higher than that in the level of the river, the specifications permitted the contractor to deposit the concrete for the footings of the piers and abutments of the new structure without unwatering the cofferdams. The site was first dredged free of obstructions, then enclosed with Wakefield sheet piling, dredging completed to the required depth, the proper number of piling driven and the concrete for the footing deposited through a tremil. The enclousure was then pumped out, the piles cut off and the neat pier constructed on the inside. The footings for the piers were made ten feet wide and the piers a minimum width of four feet eight inches at the springing line, with a batter of one in twenty-four down to the footings. The piers and abutments were reinforced with seven-eighths inch square vertical bars twelve inches center to center, which in the piers as they neared the top were joined the corresponding reinforcing bars in the top of the arches.

The bridge was designed to carry a sixty-ton interurban car, with a rise in temperature of 20 degrees Fahrenheit provided for. The arches have each a clear span of fifty-two feet they are six inches thick at the crown, reinforced on both intrados and extrados with seven-eights inch square bars twelve inches apart, with traverse and diagonal lacing. The curve of the intrados of the arch is formed by four segmental circles approaching a mean between an ellipse and a segmental circle, with a theoretical rise of six and one-half feet and an actual rise of seven feet from the springing line. The curve of the extrados is a true segment of a circle.

The bridge carries a thirty-five foot roadway with concrete gutters and an eight foot clear sidewalk on each side. The edge of the curbing is protected with an angle-iron anchored into the concrete. A gas main and electric light and telephone conduits were laid under the sidewalk. Conduits for the lighting system on the bridge were provided for in the upper rail of the balustrade. Cluster light standards similar to those used in other parts of the city were mounted on the baluster posts over each pier and abutment. Alternate light standards have a wrought iron pipe trolley pole telescoped through them to support the wires of the car line.

The contract price for the bridge was $35,600, which, together with the cost of inspection, the lighting system and other items furnished by the city, made the total cost of the structure $36,535.22.

The cement for the work was supplied by the German-American Portland Cement Works of La Salle, Illinois. All cement was tested at the mill of Robert W. Hunt & Company, of Chicago, and all tests fully met the requirements of the specifications. The contractors were well equipped to do the work and performed same in an expeditious and workmanlike manner, very satisfactory to the board of public works, consisting of James A. Fathers, Mayor; Roy M. Cummings and C. K. Miltimore, commissioners, and C. V. Kerch, city engineer.

AMERICAN ROAD BUILDERS' ASSOCIATION

Rapid progress is being made on the plans for the Thirteenth Annual Convention of the American Road Builders' Association and the Seventh National Exhibition of Machinery and Materials which will be held at Mechanical Hall, Pittsburg, Pa., February 28 to March 3.

Among the subjects of papers decided upon to date by the sub-committee in charge of the preparation of the program are the following: "Railway Tracks on paved Streets;" "Adaptability of Paving Materials;" "Bituminous Surfaces for State Highways;" "Concrete Roads;" "Recent Tendencies in Stone Block Pavements, Especially with Respect to Size of Blocks;" "Foundations;" "Control of Openings in Pavements;" "Roads at Low Cost for Moderate Traffic;" "Effects of Motor Trucks;" "Contractors' Suggestion to Engineers;" "Brick Streets and Roads." In addition to these technical papers there will be two others, both of a technical and descriptive character. One will deal with the Du Pont Road in Deleware and the other with the Columbia Highway in Oregon. Announcement of other subjects and of the names of those who will have places on the program will be made at a later date.

The general plan of presenting the various topics which will come before the technical sessions of the convention will be the same as that which has been followed for the past few years. Each subject will be introduced by the presentation of a paper prepared by some authority on the subject dealt with. The introductory paper will be followed by a formal discussion by some especially selected speaker, after which the subject will be thrown open to discussion by the convention at large, Previous experience has shown that by this method the greatest diversity of ideas can be brought out and the proceedings made of the maximum value to all.

One innovation will be made in the conduct of the convention. This will be the devotion of an entire session to the discussion of subjects selected by vote of the members of the convention. A similar plan was tried at an A. R. B. A. convention several years ago with excellent results.

The Seventh National Exhibition of Machinery and Materials will, as in former years, include displays of practically everything in the way of equipment and material that is used in building and maintaining city streets and country roads. In no previous year have the plans for the show been so far advanced or have so many applications for space been received within so short a time after the announcement by the management that assignments of space could be made. Among those who have already arranged to make displays are some of the largest and most important road material and machinery manufacturers and dealers in the United States, so that the success of the show is already fully assured.

WILL HAVE TEN GIANT GRIFFIN MILLS IN OPERATION

In the descriptive article concerning the plant of the Clinchfield Portland Cement Corporation in the January issue of Cement and Engineering News the editor made a mistake in regard to the number of Giant Griffin Mills in use. We have been informed that the Clinchfield Portland Cement Corporation have just placed an order with the Bradley Pulverizer Company for six more Giant Griffin Mills to take place of other mills which they tried out and found unsatisfactory for their use. The Clinchfield Company will have ten Giant Griffin Mills in operation in the near future, which is another indication of the superiority of the Giant Griffin Mill and it is proved conclusively that there is no better or more economical pulverizer manufactured.

In addition to these six mills the Bradley Pulverizer Company have recently sold the largest cement plant in the United States eighteen Giant Griffin Mills and have an order from the Lawrence Portland Cement Company for another Bradley Hercules Mill.

Construction of Concrete Roads in Milwaukee

County. This County Has Adopted the Concrete Road As the Standard, for No Matter What Its Life, It Is Always Available As a First Class Foundation for Any Kind of Surfacing.

BY H. J. KUELLING, COUNTY HIGHWAY COMMISSIONER.

Milwaukee County, which includes the city of Milwaukee, is twenty-four miles long by about ten miles in width. The topography is of a glaciated nature varying from flat sections that are difficult of drainage to fairly steep hills running as high as fifteen per cent grades. The soil varies from sand to very heavy clay. Thus we find in the county about all the possible conditions for the foundation of concrete roads.

When Milwaukee County commenced, several years ago, to improve its rural roads, considerable time was given to the study of various types of roads that would be suitable to its conditions. Not only was the heavy mixed traffic, commonly near a large city, taken into consideration, but the fact that the manner of transportation, both of freight and passenger, was and is rapidly changing from horse-drawn to motor-drawn vehicles. These conditions plainly showed that the construction of either water-bound or gravel macadam or any other type of pavement that was not rigid within itself, would be unsatisfactory. This brought the county to the consideration of concrete, brick and bituminous macadam, the latter two of which would be built on a concrete foundation. While it was recognized that there are both advantages and disadvantages in the concrete road, it was adopted as the standard for one reason above all others, namely, that it would eventually, no matter what its life, be available as a first class foundation for any kind of surfacing.

In 1911, Milwaukee County Board took action whereby they might improve the main roads in the county under what is known as the state aid highway law. The first step taken was the election of a county highway commissioner and the selection of the system of prospective state highways. This system of roads consisted of the main arteries leading from the important market points of the county to the county line. The system contained about one hundred and seventy miles out of a grand total of four hundred and fifty miles within the county.

It was well into the year of 1912 before plans could be completed for the construction of any roads because the selection of the roads to be improved was not made until late and the highway department was unable to get the plans completed until along in the summer. Such delays are now done away with by having all the surveys done in the fall and plans drawn up in the winter, thus enabling the highway committee and the commissioner to let contracts and plan their work during the very early spring.

During 1912 there were constructed about six miles of concrete.

Blue Mound Road.

In 1913 a much earlier start was made and as a result, twenty-two miles of concrete were constructed which was of sixteen and eighteen feet in width with a few sections that were wider.

During the year of 1914, there was constructed about twenty-five miles of concrete roads besides one and one-quarter miles of brick, two miles of tar macadam and four miles of sheet asphalt. With the exception of some of the sheet asphalt, this work was practically all completed by the first week in October.

The plans for 1915 call for the completion of about forty miles of pavement. At the end of the season of 1915 it is expected there will be twelve roads completed from the city of Milwaukee to the county line.

The amount of work done in this county during the past year is probably as large if not larger than that done in any other similar community in the middle west.

Some idea of the magnitude of this undertaking can be gained by the fact that about four thousand car loads of material were used and over four hundred and thirty thousand bags of cement.

Type of Mixture

All of the work done was of one course type which was six inches thick at the edges and eight inches thick in the middle or a uniform thickness of seven inches where placed on either side of a car line.

The general mix used during the season of 1914 was 1:2:3½ although this was varied a little where

the voids in the aggregate were found to be very low. All the cement used, was tested, by contract, at the mills, with an occasional test being made in the laboratory of the highway commissioner. Practically all of the sand and stone was washed and in every case the sand and stone were brought on the job separately. A large number of tests were run on both sand and stone to determine the percentage of voids, percentage of clay and silt, percentage of siliceous material in the sand, and the nature of the stone composing the larger aggregate. These tests were made both before the work was commenced and from time to time upon samples obtained from the job. Some idea of the thoroughness of these tests can be gained from the fact that about twenty-five cars of cement and about fifty cars of sand and gravel were rejected from time to time during the summer.

The sand was graded from one-quarter inch down with not more than three per cent passing a 100 mesh screen. With such sand a 1 : 2 mortar is a very strong mixture and in the writer's opinion is preferable to a richer mix where the sand is limited to one-eighth inch. The larger aggregate was in most cases, graded from one and one-half inch to one-quarter inch. In some well graded aggregate, the voids were found to run as low as thirty-five per cent.

While the different contractors had crews made up in various ways, the writer believes the following to be an efficient crew for county road work:

One foreman, one straw boss, one mixer engineer, one fireman, one finisher, three men receiving and striking off concrete, two men handling cement, three men handling sand, eight men handling stone, two men caring for forms and erecting all joints, one man for evening up and hand tamping subgrade, one man for covering and sprinkling, one for running pump, one waterboy who also cares for the cement sacks and one watchman.

This gives us a crew of twenty-eight men, which under favorable conditions, should mix and place an average of about six hundred square yards of pavement per day.

The writer believes that the batch should consist of two bags of cement, four cubic feet of sand in one wheelbarrow and seven cubic feet of coarse aggregate in two wheelbarrows. Such a combination makes fewer wheelbarrows to dump thus unloading the hopper more quickly and lessening the chances for errors in getting the proper mixture in any batch. Such loads may seem abnormal but the writer's experience has shown that men are willing to do this as it necessitates fewer trips every day for each man although the trips are themselves harder.

The question, "What is the cost per square yard or per mile of concrete?" is as easily answered as "What is the cost of a house?" One is as definite as the other, for there are almost as many kinds of concrete roads as there are houses; and for each kind there is a different answer. Even after the quality and thickness of concrete to be built has been determined, there are naturally many local conditions that will have a marked bearing on the results—such as lengths and kinds of road available to haul material over; facilities for unloading and hauling aggregates and cement; amount of labor available; the necessity for camps; the distance and elevation that water must be carried and also its source; the availability of suitable aggregates; whether the aggregates must be washed or crushed or shipped by rail; the weather conditions that are liable to exist. Any or several of these conditions may have a marked effect on the cost of construction. Given answers to these questions or conditions, the problem of figuring the cost becomes much simplified.

CONCRETE FRAME COALING STATIONS

Description of a Modern Concrete Coaling Station on the Chicago Great Western

Concrete Frame Coaling Station

The Chicago Great Western Railroad has erected several new coaling stations this year in addition to station buildings, grain elevators, water tanks and revetment work along the Missouri river.

Sometime ago this road adopted a policy of weighing all locomotive coal and to this end four new coaling stations were built, three of reinforced concrete and steel and one of timber construction. The first mentioned were built at Kenyon, Minn.; St. Joseph, Mo., and Carroll, Ia., and are of the Holmen type, with a capacity of 100 tons, so arranged that coal may be taken by locomotives either on the main track or the passing track under the structure.

Concrete Frame Coaling Station.

The bins, which are built of structural steel, are suspended from scales at the top of a skeleton frame of reinforced concrete consisting of four columns resting on concrete footings, securely tied together by three sets of horizontal beams or struts, as shown in illustration herewith, which is an illustration of a Carroll, Ia., plant.

On the top of this concrete frame is a steel frame covered with corrugated iron, housing the scales and weighing mechanism. The coal is dumped from cars into a pit housed over by a steel frame shed at the rear of plant and hoisted to the bins by means of automatic hoists with a capacity of 75 tons of mine run coal per hour. These hoists are operated by 15 H. P. electric motors directly connected to reversible hoists. The driving machinery is located in the concrete house shown in the left-hand corner. The entire plant is therefore well protected against any danger or disablement by fire, as is so often the case with wooden stations. One man operates each one of the plants very

easily, since they are entirely automatic in their operation.

The new stations at Kenyon and St. Joseph replace wooden trestle stations of the obsolete type, where the cost of handling the coal has averaged about 9c per ton, and the Carroll station replaces two old wooden gravity type stations at Manning and Lohrville, Ia., where the labor cost of handling has been the same as mentioned above. According to Mr. W. C. Harvey, first assistant engineer, in The Maize, the labor cost of handling coal in the new stations has been reduced to about 2½c per ton, or a reduction of about 6½c. As these coaling stations handle in the neighborhood of 85,000 tons of coal during the year, the saving in labor alone will be about $5,500 per year. Besides this, there will be a great reduction in maintenance on account of the elimination of the old style trestle type of coaling station.

Amusement Hall and General Store, Bay Ridge, Ohio, Built of Concrete Blocks.

AMUSEMENT HALL AND GENERAL STORE BUILT OF CONCRETE BLOCKS

An excellent example of concrete block construction may be seen in the photograph of the new and very handsome 36 x 55 foot amusement hall and general store built by the Sandusky Portland Cement Company, for the use of employes at its Bay Bridge plant.

The building fulfils a long felt want, the factory being situated at Bay Bridge, six miles from Sandusky, Ohio, and consequently in a somewhat isolated locality.

The hall has been very enthusiastically received and the entertainments held in it have contributed in no small degree to the pleasure of the residents. The general store is also a great convenience.

The structure comprises upon the ground floor a general store, billiard room, and four-room apartment for the storekeeper and his family. The second floor is devoted entirely to a large hall for dancing, lectures, moving picture shows, theatricals, etc. At one end is a stage 16½ x 15½ feet, with a dressing room 9 x 16 feet on each side of the stage.

The fittings are unusually complete and include electric lights (current being furnished from the company power house) and hot air heating from a furnace situated in the basement. Considering the generous size and exceptionally high grade construction the cost of the complete building, approximately $3,500, is remarkably low.

We give herewith the plan used and a few brief notes upon the more important features of construction.

Concrete blocks, rock face, cast in a Zagelmeyer machine were used throughout. Instead, however, of being of the conventional hollow type these were solid, 8 inches thick, for the first story and 6 inches thick in the second. These in place cost approximately 14 cents per square foot. All blocks were 1 to 4 cement and crushed limestone with 2 per cent Medusa Waterproofing added to the ¾-inch facing, the stone being screened where necessary to ¼ inch. Great care was exercised to prevent the slightest effect of similarity in the facing, 16 different face plates being used and the blocks being carefully selected to prevent such injury to the good looks of the building. The result is all that could be desired. The walls have a very attractive appearance with none of the effect of sameness so noticeable in many concrete block buildings. It would be difficult to determine from their appearance that the walls were not constructed of a very high grade (and far more expensive) cut stone.

All foundations are of 1 part cement, 2 parts sand and 5 parts crushed limestone. Mortar for blocks was mixed in the proportions of 1 cement, 2 hydrated lime and 4 sand.

Medusa Gray Portland Cement was used, 2 per cent by weight of Medusa Waterproofing being added for foundations, mortar and facing of blocks. The building is absolutely dry. There has been considerable doubt about getting a damp-proof building by using solid blocks, but Medusa Waterproofing has solved the problem very satisfactorily.

NEW USE FOR CONCRETE.

A remarkable bit of engineering is being carried out by the Netherlands department of waterways off the southern point of the island of Texel where the sea defenses of Texel and of Den Helder (in North Holland) are in much need of strengthening. It was found that the set was "scouring out" the bottom at the foot of the dikes that protect the land. This scouring out, or "eating into," the sands a long way from the foot of dikes was first noticed several years ago on the coasts of the island of Schouwen in the province of Zeeland. Gradually the waters ate their way far under the dike foundations, so that the dikes crumbled away and fell into the sea. It seemed as if the defense of Schouwen would have to be abandoned, but the engineer of the provincial department of waterways, Yonkeer de Muralt, conceived the idea of strengthening the bottom of the sea by laying a flooring of concrete. This method was so effective that his system has been adopted by the Netherlands government wherever the coast is menaced.

CEMENT AND ENGINEERING NEWS

(PUBLISHED MONTHLY)

WILLIAM SEAFERT, Editor and Publisher

Office—672 Transportation Building, Chicago

Telephone, Harrison 5397 Cable Address, "Seaferts" Chicago

Entered at the Post Offfce at Chicago, as second-class matter, July 21, 1896 under Act of March 3, 1879

SUBSCRIPTION RATES:

United States, Canada, Philippine Islands and Mexico, two years for $1.00; all other countries, $1.00 per year.

DISCONTINUANCES—The greater part of our subscribers prefer NOT to have their subscriptions interrupted, in case they fail to remit promptly for renewal. It is therefore assumed, unless notification is given to the contrary, that the subscriber wishes to continue taking our paper. Therefore CEMENT & ENGINEERING NEWS will be sent until we are notified to discontinue—Such notice should be sent when the subscription expires.

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CHICAGO, FEBRUARY, 1916

CEMENT AS SOLUTION OF ROAD PROBLEM IN RURAL DISTRICTS

As is the case in towns and suburban localities, rural communities are turning to concrete as the solution of the road problem. In practically all sections of the United States the concrete road is gaining in favor. Public approval or appreciation of the concrete road is based upon practical observation as to its extreme utility, reasonable first cost and the almost negligible outlay required for maintenance. Farmers have discovered that no road can compare with the concrete road, considered as an economic proposition. For a time they hoped that the old macadam type would continue to serve their needs, especially if thoroughly well-built and cared for, but they have been forced to realize that in the case of every macadam road subject to automobile traffic, destruction is inevitable. In the old days of horse and wagon traffic, iron-shod hoofs and steel tires constantly created new binding material by wearing down the stone, but under automobile traffic the rapidly revolving tires disperse the rock-dust or binding material in clouds, and the stones, upon exposure, are ripped out and hurled aside. The situation has become acute, and thus it is imperative for every community to decide whether it will submit to bad roads, pay excessive annual maintenance charges or pay for a road so solid that it will never get out of repair. In many localities farmers have dismissed the first two propositions as impossible and they are building durable roads. And some of them believe it is better to do this by local taxation rather than to have the state take over and control the roads, thus depriving them of the right to say what type of road shall be built. It was the farmers who defeated the recently proposed 50-million dollar bond issue in Pennsylvania. They wanted the opportunity to build roads that would not be utterly destroyed long before state or county bonds should mature. In Connecticut, Maryland, New Jersey, New York, and Pennsylvania, both state and local communities are turning to the concrete road as the solution of their problem and with excellent results.

Taking a 16-foot concrete road as a basis, highways of this character have cost on the average about $12,000 per mile, while maintenance costs have been practically nothing. For example, in Bellefontaine, Ohio, a concrete road put down twenty years ago has cost less than $25 per mile per year for maintenance, while the average maintenance cost of macadam roads in five eastern states in 1912 exceeded $800 per mile per year. The farmer, in adopting concrete, has figured the matter this way: A road is an investment. The most conservative estimate of maintenance cost on macadam per mile per year would be certain to reach $300 if the road is subject to motor-driven traffic and kept passable at all seasons. An equally conservative estimate for construction is $6,000 per mile. The $300 maintenance cost represents interest on $6,000 at 5 per cent, thus making the real investment $12,000 per mile, or the cost of a mile of indestructible concrete road. As a matter of fact, taking New York, New Jersey and Pennsylvania costs, the investment would be some $25,000 per mile. From considering a single mile of roadway it becomes interesting to figure costs on many miles to see what would happen in the case of macadam as compared with concrete. For example, let it be assumed that 500 miles are to be built during a period of five years at the rate of 100 miles per year, and that repairs will not be required on either type of road for two years. Beginning, then, at the third year, and estimating maintenance costs for concrete at $25 per mile per year, the Bellefontaine figures, the total maintenance costs on 500 miles of concrete road would, at the expiration of seven years, be only $37,500. In the case of macadam, basing costs on New York and New Jersey figures for 1912, repair costs would reach the enormous total of $1,350,000. Where concrete roads are very narrow, say 10 feet wide, and have a dirt road at the sides, they could be built for $7,500 per mile. Maryland has built excellent concrete roads of standard 16-foot width for a little less than $12,000 per mile.

It is upon the above economic basis that farmers are beginning to look at the road question.

But aside from moderate first cost and practically negligible maintenance costs, the popularity of the concrete road is rapidly growing in rural communities due to the experience of those who have used it. For the farmer it is the ideal highway. Described briefly, the building of a concrete road consists of putting a wet and mushy mass of Portland cement, sand and stone in the center of a highway, where it hardens into imperishable rock. The accompanying illustrations give a very good idea of the building of a road and its appearance when finished. The first picture shows the construction of a concrete road near Madison City, Iowa. The concrete has been placed between rigidly staked side forms. The road is then brought to proper contour with the templet and subsequently troweled with wooden floats. The view of the finished road in Maryland shows its admirable surface. This type of road appeals especially to the farmer and his family, because it provides them at all seasons with an excellent place to walk as well as a thoroughfare for vehicles. It is a fact that in Wayne county, Michigan, children go to and from school on roller skates over the wonderful concrete roads of that locality. Horses never slip or fall upon these roads and will draw twice or three times their accustomed load. In Wayne county one farmer has driven an unshod horse over the concrete roads for a long period of time without injury to the animal. It is needless to say torrential rains cannot wash through these roads. The water must go over or under them. Another especially good feature of the concrete road is its freedom from dust a well as mud. Wherever farmers have used these roads they are enthusiastic in their commendation, not only because of their great durability and low maintenance cost, but because in every sense they represent the ideal highway and, therefore, the solution of the road problem as it applies to rural communities.

RAHWAY RIVER ARCH BRIDGE, PENN. RAILROAD

A Six-Track Concrete Arch Bridge Built in Connection with Grade Crossing Elimination at Rahway, N. J.

The largest structure built in connection with the elevation of the Pennsylvania R. R. roadway between Elizabeth, N. J., and Colonia is the six-track concrete arch bridge, 120 ft. wide, composed of three 60-ft. arches, over the Rahway River at Rahway, N. J., which was built without interfering with traffic, which is unusually heavy at this point. In addition to this large structure the work involved a very heavy concrete retaining wall and underpass construction and fills, some of which are 25 ft. high. Fifteen grade crossings were eliminated by carrying tracks over same on through and deck plate girder spans with 12-in. reinforced concrete slab floors of trough construction between girders and waterproofed with felt and a bituminous compound covered with brick.

The construction work was carried on by a cableway system 850 ft. long, with 65-ft. and 75-ft. towers, one located on bank of river and the other across the street at the west end of bridge, this street being bridged by a through plate girder span shown in Figure 2, which is really a continuation of the arch bridge, since a combination abutment serves as a support for both. From the concrete plant located on the north bank of the river the concrete was distributed to various points on the structure in buckets by means of the cableway.

Comment

The lines of this structure, although very plain, are very graceful and effective. The illustration gives an excellent idea of how a massive concrete structure can be made to present a pleasing appearance by the use of scoring joints, heavy but plain copings, recessed paneled pilasters, and a rubbed surface finish.

The bridge was built by the Keystone State Construction Co., of Philadelphia, under the direction of Mr. A. C. Shard, chief engineer of the Pennsylvania Railroad.

Fig. 1—Six-Track Concrete Arch Bridge, Rahway, N. J., Pe nna. R. R.

General Design.

The arches of the Rahway River bridge are 3 ft. thick at the crown and are of plain concrete. Spandrel walls of a gravity section retail the earth fill over the arches. The backs of arches are waterproofed in the same manner as the floors of steel bridges over streets.

The showing faces of arch rings, spandrel walls, wing walls and coping were finished by rubbing the surface of the concrete with carborundum bricks. The outlines of the arch rings were delineated by V-shaped grooves and the voussoir or construction joints in rings were marked in the same manner. The plain surface of wing walls was relieved by horizontal coursing joints 2 ft. apart, and the divisions between arches are marked by paneled pilasters carried up from piers to top of coping.

Construction.

The bridge was built in four longitudinal sections of 25 ft. width, the centering having been built for this width and moved laterally on rollers as each section was completed. The piers were built on 25-ft sections in the same manner. Transversely the arches were poured in five voussoir sections as indicated by the voussoir joints in illustration.

MANEY SCRAPER

F. F. Foster & Co., Inc., 443 E. Third St., Los Angeles, Calif., have been appointed exclusive representatives in Southern California for the Baker Manufacturing Co., 552 Stanford Ave., Springfield, Ill., manufacturer of the Maney Four-Wheeled Scraper. D. G. Bevis of the Foster company, who has charge of the sales of this equipment, reports that a number of these Maney scrapers are being worked on Conner Contracting Co.'s contract in Riverside county and are moving dirt at a cost much lower than had been expected.

VIRGINIA PORTLAND CEMENT COMPANY NEW OWNERSHIP

Mr. R. W. Kelley, president of the Virginia Portland Cement Company, Fordwick, Va., together with Michael Gavin, vice-president, and F. W. White, treasurer, have retired from their respective offices in the company. Mr. Harry C. Trexler has been elected president, E. M. Young, vice-president, and Alonzo F. Walter, treasurer, to succeed the previously named officers.

World's Highest Concrete Water Tower Tank

Recently Built for the City of Middleboro, Mass. Capacity 500,000 Gallons. Height 172 Feet.

The present article describes the design features of and methods of constructing the highest reinforced concrete water tank yet built. This structure, which has a capacity of 500,000 gallons, was recently built for the city of Middleboro, Mass. The tank has a hemispherical bottom and is supported on a cylindrical tower. The total height of the structure is 172 feet.

Local conditions required the storing of 500,000 gallons of water at an elevation sufficient to meet the com-

bined demands of domestic and fire service. The most economical type of structure fulfilling the requirements was a tower-tank, an elevated tank supported on a tower, and the only practicable materials for building such a structure are steel and reinforced concrete. A steel tower-tank was estimated to cost about $2,000 less than one of concrete, but the cost and inconvenience of frequently painting it inside and outside, a safe life of not over 30 years, its unsightly appearance, and other considerations made it apparent that if a satisfactory watertight concrete tank could be constructed it was greatly to be preferred to a steel structure. The difficulties, however, of designing and building such a structure, especially of the proportions required, were many and vital. The success or failure of a reinforced concrete water tower-tank, perhaps more than in any other engineering structure, depends to a large degree upon each individual connected with the work from the time the concrete materials are selected until they are placed. With due regard for the difficulties involved it was decided to build the concrete structure here described. The essential details of the design are shown in Fig. 1.

Foundation.—The foundation extends 7 feet below the finished grade and rests upon a fine, well compacted sand, the safe bearing power of which was determined experimentally by loading a timber set at the elevation of the bottom of the foundation. At a loading of from 1 to 3½ tons per square foot, the settlement was uniform and slight, being only 1/32 in. for each additional ½ ton; but 4 tons per square foot produced a relatively large settlement—5/32 in. for the last ½ ton. The footing area is such that with the total dead weight of 4,485 tons the soil is compressed to the extent of 2.38 tons per square foot. The wind load was computed from an assumed velocity of 70 miles per hour, the equivalent of 30 lbs. per square foot on a vertical projection of the structure, which with a full tank adds a maximum of 0.68 tons, thereby giving a total maximum pressure of 2.96 tons per square foot. Although the resultant of the wind pressure is slightly more than doubled with an empty tank, it is more than offset by the reduction in the dead-weight of the water, so that the maximum mentioned represents the worst condition.

Tower.—The cylindrical tower was adopted in preference to a number of columns, because structurally it seemed a safer type of support, would probably be more economical to construct and could be made to present a more pleasing appearance. Considerable study was given to the architectural side of the problem in order to produce at a moderate cost a structure that would be, to some extent at least, an addition to the landscape. The completed structure is shown in Fig. 2. The plain aspect of a simple cylinder is relieved by the addition of twelve 4 x 24 in. pilasters, which were assumed to take their proportion of the load. The appearance of solidity at the bottom is accomplished by a concrete seat extending around the base of the tower. A balcony of reinforced concrete with bracket supports, paneled posts and railing, the floor of which is 108 ft. above the ground, furnishes a suitable point of vantage for inspecting the outside of the tank and provides a visual starting point for the tank proper. The thickness of the tower wall between pilasters is 10 ins. and the greatest compression due to the dead load is 483 lbs. per square inch, increased to 631 lbs. by a 70 mile gale. Entrance to the tower is through an iron door. Light and ventilation are provided for by means of twelve windows, three of which are arranged to open. An iron ladder within the tower leads from the ground to the balcony through an opening in the wall of the tower at the elevation of the balcony floor. Another iron ladder on the outside of the tank connects the balcony with the roof above. A 16-in. cast-iron flanged pipe with expansion joint, rises from the ground and enters the tank at its center. An 8-in. overflow and drain discharges at a safe distance from the tower.

Tank.—The tank proper, 41 ft. in inside diameter and having a depth of water at its center of 59 ft., has a capacity of slightly over 500,000 gals. The bottom of the tank is a hemispherical bowl hung at its rim from the wall of the tower, and marks the first application of this type of bottom to an elevated concrete tank, although for many years it has been used with success in elevated steel tanks. The bowl itself has a capacity of 125,000 gals. The vertical wall of the tank varies

AMERICAN CONCRETE INSTITUTE CONVENTION

The Annual Convention of the American Concrete Institute will be held at the Auditorium Hotel, Chicago, February 14 to 18. Among the membership of the Institute are included some of the foremost names in the United States of engineers and architects. A glance at the enclosed program will indicate the nature and scope of the discussions which will take place at this convention.

in thickness from 10 ins. at the top to 16 ins. at the bottom and the hemispherical bowl from 18 ins. at its connection with the tank wall to 14 ins. at its center. The thickness of concrete is such that without any assistance from the steel reinforcement its stress in tension is about 250 lbs. per square inch. The tensile stress in the steel acting independently is approximately 14,000 lbs. per square inch; and with both materials acting in conjunction the computed stresses are 215 and 2,150 lbs. The tank is covered to guard against the growth of algae, not uncommon in a filtered water supply exposed to light, and to prevent freezing. The roof is a concrete dome 4 ins. thick, 41 ft. in diameter and with a rise of 4 ft. at the center. The thrust is carried by steel reinforcement embedded in the top of the tank wall.

Concrete.—Whitehall cement from the Whitehall Portland Cement Co.'s mill at Cementon, Pa., was used throughout the work. Sampling and testing was done by the New England Bureau of Tests of Boston, samples being taken as loaded on the cars which were then sealed. The tests of the 12 carloads required, aggregating 8,100 bags, were unusually uniform and satisfactory, especially for the essential qualities of strength, fineness of grinding and slow initial set. The sand and coarse aggregate were obtained from a gravel pit about 1¼ miles distant, screened by hand at the pit to give the sizes required. The sand was tested for tensile strength as compared with standard Ottawa sand and gave an average of 112½ per cent thereof. The gravel stones were washed to remove a slight coating of clay and cemented sand. The proportions of the concrete for the foundation are 1 of cement, 2½ of sand and 5 of gravel stone; for the tower 1:2:4; for the hemispherical bottom and wall of the tank to elevation 279, 1:1:2; from elevation 279 to 293, 1:1½:3; and above elevation 293, including the dome roof, 1:2:4. The relative amounts of sand and stone were somewhat varied to provide the densest practical mix, the percentage of cement to the sum of the aggregates, however, remaining as stated. The amount of concrete used in the work was 1,120 cu. yds.

Steel Reinforcement.—"Havemeyer," round, deformed, open hearth, hard grade reinforcing rods furnished by the Concrete Steel Company of New York, and bent at the rolling mills, were used in the structure. These were tested at the Carnegie mills by the New England Bureau of Tests, a large proportion of which were 1¼ in. and developed an ultimate tensile strength of 120,000 lbs. per rod. Laps were 40 diameters and in addition each joint in the tank was secured by two cable clips. The horizontal rods of the tank were firmly secured in their true position to 16 vertical 3-in. channels drilled to the exact spacing of the rods. A total of 160,000 lbs. of steel reinforcement were embedded in the concrete.

Forms.—Steel forms were used for the outside surface of the tower and tank. Two complete rings were provided, each 4 ft. in height, at a total cost of $600. Two 4-ft. rings of wooden forms were used on the inside at a first cost of $400. The use of steel forms was justified both on account of considerable saving in time and expense in erection and because of the resulting smooth, dense surface, requiring very little finishing and less susceptible to the action of the elements. The hemispherical bottom was cast between forms consisting of wooden ribs covered with sheet iron.

Joint Between Old and New Concrete.—For the tower, in order to secure a bond between the successive rings of concrete, the forms were overfilled about ¼ in., which surplus containing the laitance was screened off previous to the initial set of the concrete, following which as soon as the final set occurred the surface was wire-brushed to expose slightly the stones and immediately before placing fresh concrete, washed with a hose stream and coated with a neat cement grout. For the tank, in addition to the above precautions which were carried out with special care, there was cast in the old concrete a continuous triangular groove, about 1½ ins. in depth, running around the wall near its center and subsequently filled with grout and concrete; to still further minimize the chances of leakage at each horizontal joint an uncoated steel plate or dam of No. 14 gage metal 10 ins. wide, turned over 1 in. at each edge to form a channel and bolted together to form a continuous watertight stop, was embedded 4 ins. into the old work, thus leaving 4 ins. extending up for a bond with the new concrete. The cost of 12 channel rings in place was about $400.

Progress of Work.—Ground for the foundation was broken on April 26, 1915. After the excavation was completed the earth was wetted and thoroughly compacted by rammers, following which a 2-in. layer of concrete was placed over the entire surface to serve as a working base for the erection of the steel reinforcement and as a suitable medium upon which to place concrete. All concrete was mixed in a 15 cu. ft. Smith mixer operated by steam and discharged into a bucket elevator which at the desired height was tripped and dumped into a receiving hopper, whence it was conveyed by gravity through a sheet steel chute to a central distributing hopper, and finally by means of eight movable wooden chutes was deposited between the forms around the circumference.

The concrete materials were brought to the mixer in dump cars running on an inclined industrial railway and pulled up the incline by a cable attached to a drum of the hoisting engine. The average rate of progress on the tower was a 4-ft. ring each alternate day, with a marked increase in efficiency as the work advanced. The actual time required for concreting was about 4 hours to each 4-ft. section. The bottom of the tank, including 4 ft. of the wall immediately above the tower was poured continuously. Concreting began at 5 a. m. on September 9, and the last batch was deposited at 4 a. m. the following day, during which time about 130 cu. yds. of 1:1:2 concrete were placed. Five days elapsed before following section was in place and two more days before the succeeding ring was concreted. Four days were then spent in preparing for future operations, so that when concreting began again on the fifth day, the following eight successive lifts were made in nine days and it was only due to a violent gale of about 70 miles per hour that operations had to be suspended for one day. The roof of the tank was poured on October 13.

Watertightness.—As soon as the forms were removed from the inside of the tank and the staging from around the outside, the surfaces were cleaned and so far have received no further treatment, although after the tank has been fully tested and accepted as satisfactorily watertight, the question of waterproofing the inside and damp-proofing the outside surface will be considered. Coincident with the removal of the outside staging around the tower, the surface was cleaned and washed with a brush coat of neat cement grout, mixed in the proportion of 1 of cement to 1 of water. The cost of cleaning and coating the 14,000 sq. ft. of surface was $64, or about 0.46 ct. per square foot. In connection with the subject of watertightness, the following clause from the specifications may be of interest:

"The concrete in the bottom and wall of the tank shall be substantially water tight at all times. Any leakage amounting to jets or visible seepage shall be repaired by and at the expense of the contractor and by

methods approved by the engineer. Small damp spots, if few in number, which do not increase nor disfigure the appearance of the concrete, will be considered to meet the requirements hereunder. It is intended that the work shall be sufficiently waterproof that severe freezing will not at any future time threaten the integrity of the concrete and that the general appearance of the structure will not suffer through efflorescence or other disfiguring stains."

The work, including grading and cleaning up, is now completed, and it is hoped that water may be turned into the mains on January 1. The static hydrant pressure with a full tank will be 84 lbs. in the higher residential area, 104 lbs. in the business center and 120 lbs. in the low district along the Nemasket River, reduced by about 20 lbs. by frictional losses during an ordinary fire. For the year 1914 the population supplied with water was 5,000 and the average daily consumption was 320,000 gals., so a storage equal to a 36-hour demand is provided by the new tank.

Acknowledgment

The structure here described was designed by Mr. George A. Sampson, Civil Engineer, Boston, Mass. The contract was executed by the Hennebique Construction Co. of New York City. The contract price was $23,140. Mr. Thomas F. Dorsey, representing Mr. Sampson, was resident engineer in direct charge of the construction work. Mr. Alvin C. Howes is chairman of the Board of Water Commissioners and is Superintendent of Water Works at Middleboro. The information here given is from a paper by Mr. Geo. A. Sampson before the December meeting of the New England Water Works Association.

Ornamental Concrete Entrance to Selig Zoo, Los Angeles, California.

ORNAMENTAL CONCRETE ENTRANCE OF SELIG ZOO, LOS ANGELES, CAL.

The Selig Jungle-Zoo, recently opened to the public in Los Angeles, Cal., opposite Eastlake Park, for the Selig Polyscope Company, producers and manufacturers of high class motion pictures, as illustrated herewith, has for an entrance one of the most interesting pieces of ornamental concrete casting on the Pacific coast. The modeling was done in clay. The casting was done in plaster and glue molds. A small amount of finishing was done with the chisel. At each side of the roadway at the entrance is a tower of pleasing architectural design, pierced by an archway through

Selig Zoo, Los Angeles, California.

which foot passengers enter. On either side there is an attractive building, one a ticket office and the other a switch-room.

The main frieze contains a large number of finely modeled birds and animals in bas-relief, there being no two alike.

In the molding surrounding the entire structure is worked out a continuous procession of animals' heads, several hundred in number and again no two alike. It is said that the designer exceeded the limits of zoology in search of suitable specimens and was compelled to adopt some from mythology.

The entire structure is of concrete, the walls being 18 inches thick. The center group of eight nearly full sized elephants is unusually interesting and life-like, as are also the animals on the pedestals adjoining the towers opposite them. The entrance cost nearly $75,000.

The entrance is of Medusa White Portland Cement with red tile roofs.

Selig Zoo, Los Angeles, California.

CEMENT STUCCO RESIDENCE

The residence of G. A. Boeckling, president and general manager, Cedar Point Pleasure Resort Co., Sandusky, Ohio, is of hollow tile construction. First and second coats of exterior stucco are Medusa Gray Portland Cement, and the third or finish coat of 1 part Medusa White Cement and 2 parts crushed white marble.

Terrace walls and curb walls around walks were also finished in Medusa White and crushed marble. Sidewalks are red brick, laid with white cement mortar composed of 1 part non-staining Medusa White Portland Cement and 2 parts white silica sand.

REICHERT ADJUSTABLE METAL MOLDS FOR MONOLITHIC CONCRETE CONSTRUCTION—BUILDINGS—TANKS—SILOS, ETC.

The new catalog of Reichert Mfg. Co., 1442 Booth Street, Milwaukee, is just off press. Send for copy.

Cement Stucco Residence of G. A. Boeckling, Sandusky, Ohio. W. W. Hodges Company, Cleveland, Ohio, Were the Architects.

Concrete Plaster House, Wilmette, Ill.

Concrete Block Barn Built by a Farmer at Warrenville, Ill.

One of the World's Largest Crushing Plants

Crushing and Screening Capacity 1,000 Yds. Per Hour.

One of the world's largest rock crushing and storage plants with a crushing and screening capacity of 1,000 yd. per hour of commercial sizes of product, is owned by the Tompkins Cove Stone Company, at Tomkins Cove, on the west side of the Hudson River, about 40 miles from New York. It is located alongside the main tracks of the West Shore Railroad, on the river bank adjacent to the company's quarry, which includes over 200 acres of exceptionally hard solid limestone rising to a height of 200 ft. above the river, all of which is available for advantageous quarrying and producing excellent stone with little or no waste labor or material.

The quarry has been operated for about 70 years and millions of yards of stone have been taken from it, in three benches having a combined height of 200 ft.

General View in the Quarry, Showing Crushing Plant in Left Background

Among the notable features of the plant are its capacity, 8,000 cu. yds. in ten hours, is believed to be larger than that of any similar plant; quantity, quality and location of the rock supply; favorable topographical conditions and facilities for shipment by rail or water; construction, which is fireproof throughout, equipment, which is of the latest improved type, in many cases of special design; automatic operation and elimination of a large proportion of labor; electrical distribution of power; capacity of the crushing rolls, sufficient to receive the largest stone quarried there; automatic separation of the product into different commercial sizes; provision for manufacturing, storing and delivering different commercial sizes in different quantities; balanced proportions of the different elements of the installation; rapidity of handling and economy of production.

The rock is blasted from a high vertical quarry face, loaded by steam shovels to cars on a high level track, and drawn an average distance of about 800 ft. to the top of the crusher house. It is dumped directly into the crusher hopper and passes vertically downward through three successive sets of horizontal crusher rolls, which reduce it to a maximum size of about 2 in. From the lower rolls it is raised about 90 ft. by a steeply inclined steel pan elevator which discharges into a hopper in the top of the preliminary screen house. This hopper discharges into a distributor that spreads the broken rock evenly over a gravity screen that removes all stone larger than 1½ in. and delivers it to a belt conveyor by which it is returned to the last pair of rolls.

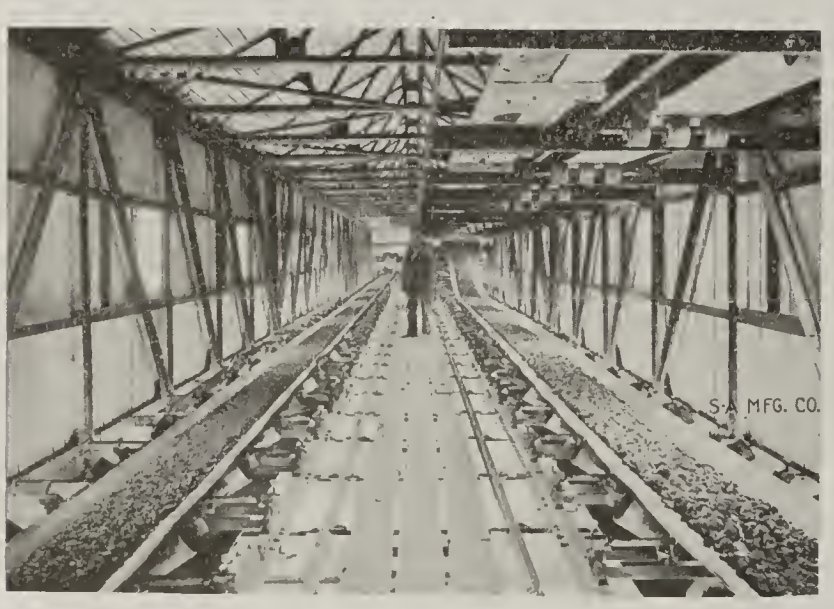
About 90 per cent of the product which passes through the preliminary screen is delivered by a belt conveyor 362 ft. long, inclined about 10 deg., to the top of the main screen house where it passes by gravity vertically through a stationary distributing and screening apparatus which separates it into 1½-in., ¾-in. and ⅜-in. sizes, each of which is discharged on a separate horizontal belt conveyor and dumped into one of the five storage bins with a combined capacity of 20,000 cu. yd.

The loading capacity is at present about 600 yd. per hour. Both loading and shipping capacities can easily be largely increased at any time by the installation of wider belts in the present conveyors.

The conveyor galleries, supporting trestles and towers, and the roofs, beams, girders, and columns of the crusher and screen houses and power house are of structural steel, sheathed with corrugated iron. All floors are of concrete, all foundations on solid rock. Excepting the steam shovels, locomotives and the main jack shaft operating the crusher roll, all of the equipment is operated by separate electric motors of the Allis-Chalmers make, and all electric wires that otherwise would be dangerously exposed are run in pipe conduits.

At present the stone for the new plant is taken wholly from the upper bench of the quarry because its floor, at the same level as the receiving platform of the crusher house, enables an abundant quantity of stone to be easily delivered.

The face of the upper bench of the quarry is about 140 ft. high and 700 ft. long and is worked by full depth holes of a uniform diameter of 6 in., drilled by three Keystone well drills operated day and night by two men each. The holes are about 8 ft. apart in rows 30 ft. back from the face of the quarry, are each charged with from 400 to 600 lbs. of 60 per cent dynamite, chiefly furnished by the Du Pont de Nemours Powder Company, and are fired in groups of 5 to 6. The rock, which is not stratified, is shattered in irregular pieces, roughly cubical, nearly all of which are within the capacity of the three Bucyrus steam shovels, having 3½-yd. dippers.



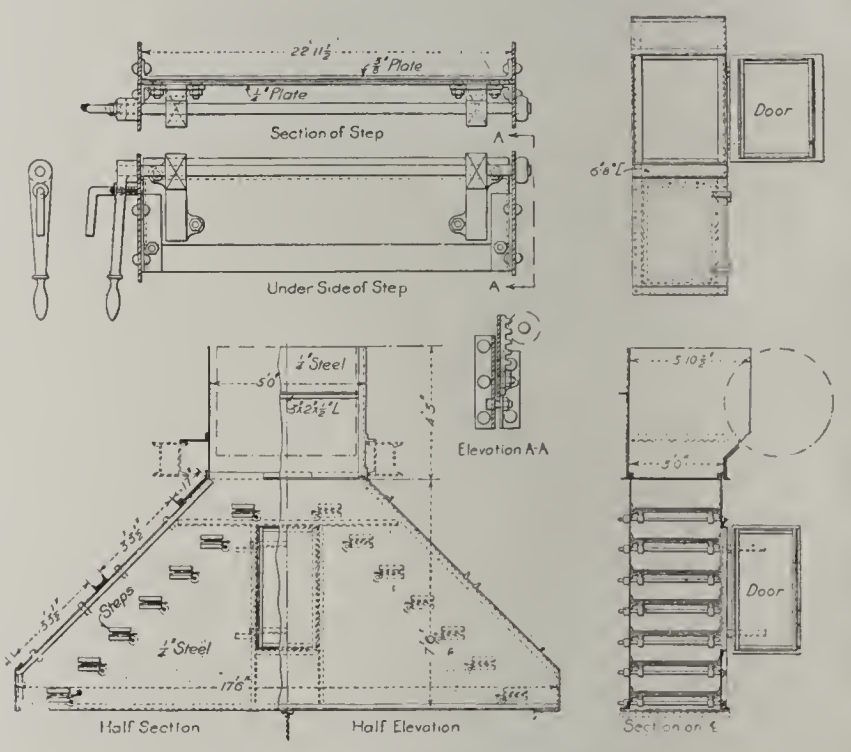
Belt Conveying System.

The shovels load the stone into 8-yd. 6½ x 9 ft. steel skips 4½ ft. deep. The skips are set on separate steel frame standard gauge cars, and are drawn by 40-ton locomotives to the crusher house. There are in the quarry and around the plant about 3 miles of standard gauge track laid with 80-lb. rails.

The loaded skips are delivered at ground level in the upper story of the crusher house on both sides of the first rolls. They are unloaded from the cars by a counter-weighted whip line led over a sheave in the roof and thence to a hoisting engine. The skip is dragged to the receiving table where its forward lower edge engages a stop against which it is revolved upward to dump its contents into a vertical sided hopper made of heavy ribbed sectional cast-steel plates with a 7 x 9 ft. rectangular opening to the rolls.

Any stone which can be loaded in a skip or handled by a shovel is quickly crushed by the rolls, which reduce a 9 x 4½ x 4½ ft. hard stone to 6 or 8-in. pieces in 10 seconds. Sometimes larger pieces are chained and loaded, and when by accident a piece is delivered which is too large to pass through the opening, or jammed diagonally, a short hole is quickly drilled in it by a pneumatic tool and a light charge of dynamite fired without removing it from the bin. This breaks it enough to enable it to drop into the rolls and it is immediately crushed without difficulty or injury to the machinery and with very little loss of time.

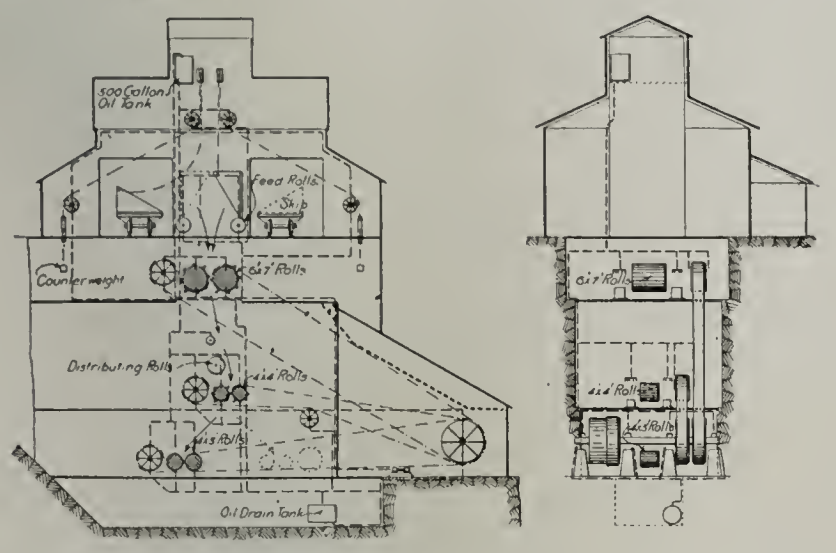
Loading Bridge for Both Barges and Railroads, with Crushing Plant Screenhouse, Storage Bins and Distributing Gallery on the Right.



Details of Distributing Scheme.

The 60 x 123-ft. power house on the second bench of the quarry, close to the vertical face of the rock, has a trussed roof about 20 ft. high in the clear and is divided by an interior row of columns in two parts with separate double pitched roofs and monitors. In the 43 x 60 ft. boiler room there are installed a battery of three 300 H. P. boilers with room for one more, two 12 x 8¼ x 12 in. Davidson single-acting feed pumps, and a Cochrane water heater and purifier. Two boilers supply all the steam at present required, leaving the third always in reserve. A sidetrack from the boiler house to the main line of the West Shore Railroad and an elevated coal storage bin with automatic feed to the boilers has been provided.

In the 60 x 80-ft. engine room there is installed one heavy-duty cross-compound 18 x 36 x 36-in. condensing engine of the Reynolds type direct-connected to a 500 K. W. generator furnishing a 500 volt, 25-cycle, three-



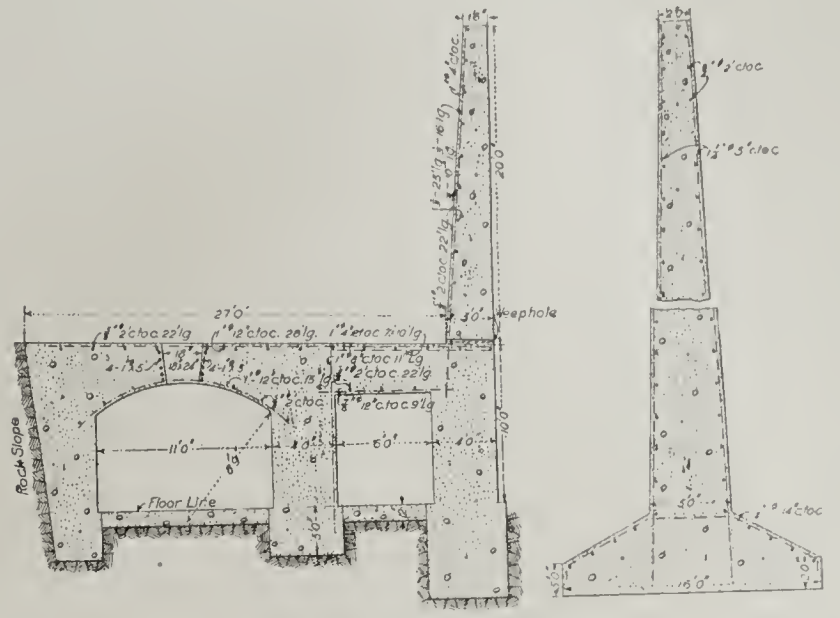
Arrangement of Crushing Rolls, Belt Drive and Oiling System.

phase current for all electric light and power throughout the plant. There is also installed a 1,000 H. P. heavy-duty cross-compound 22 x 44 x 42-in. condensing engine of the Reynolds type, connected to a 15-in. jack shaft 36 ft. long with two double face pulleys 10 ft. in diameter belted to the crusher rolls.

Condensation water is pumped from the river through a 10-in. spiral riveted pipe by a centrifugal pump driven by a 30 H. P. motor, and is returned to the river through a pipe of the same diameter. There is also in the engine room a large air compressor and the usual complement of oil separators, traps, filters and a gravity oiling system. The engines and generators were installed by the Allis-Chalmers Company, Milwaukee, who also furnished all of the 13 motors from 15 to 150 H. P., which are required in different

in the roof of the crusher house and the rolls are supported on very heavy steel girders.

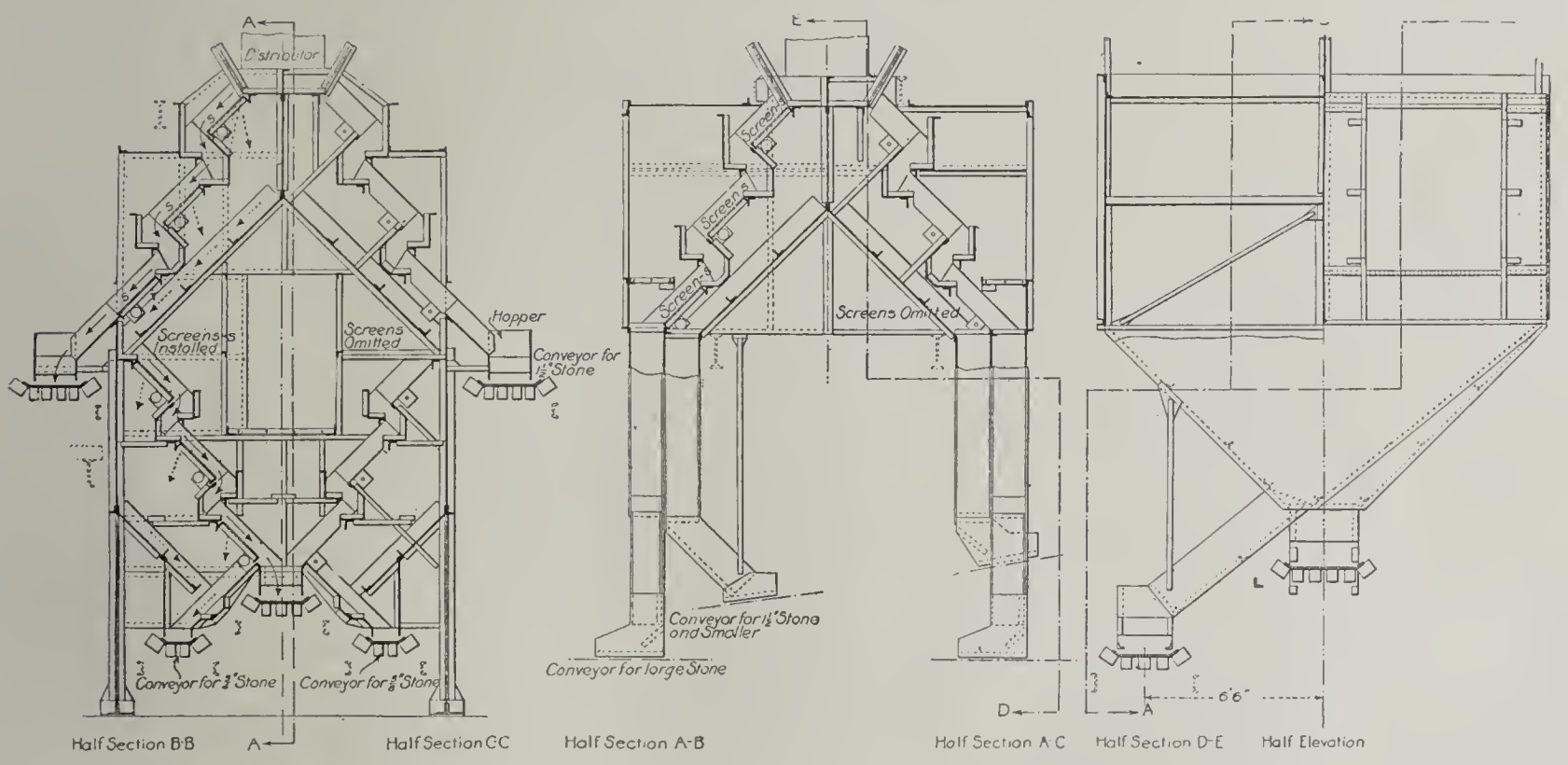
The general arrangement is indicated in the isometric view of crusher house. The first or upper pair of crush-



Showing Concrete Construction Details of Storage Bins.

ing rolls, 6 ft. in diameter and 7 ft. long, are run at 180 R. P. M. and will crush the stone much faster than it can ordinarily be delivered. They are set about 6 ft. 6 in. apart on centers and have forged steel mandrels about 5 ft. in diameter to which are cap-bolted 16 half length segmental surface plates of chilled cast iron 6 in. thick with projections or spurs about 3 in. long. On one of the rolls, two diametrically opposite longitudinal rows of spurs are 6 in. long, and act as sledges to break the rock which is crushed between the other spurs.

Horizontal feed rolls 30 in. in diameter, and both operated by a 15 H. P. motor, are set, one on each



Sections of Main Screen House.

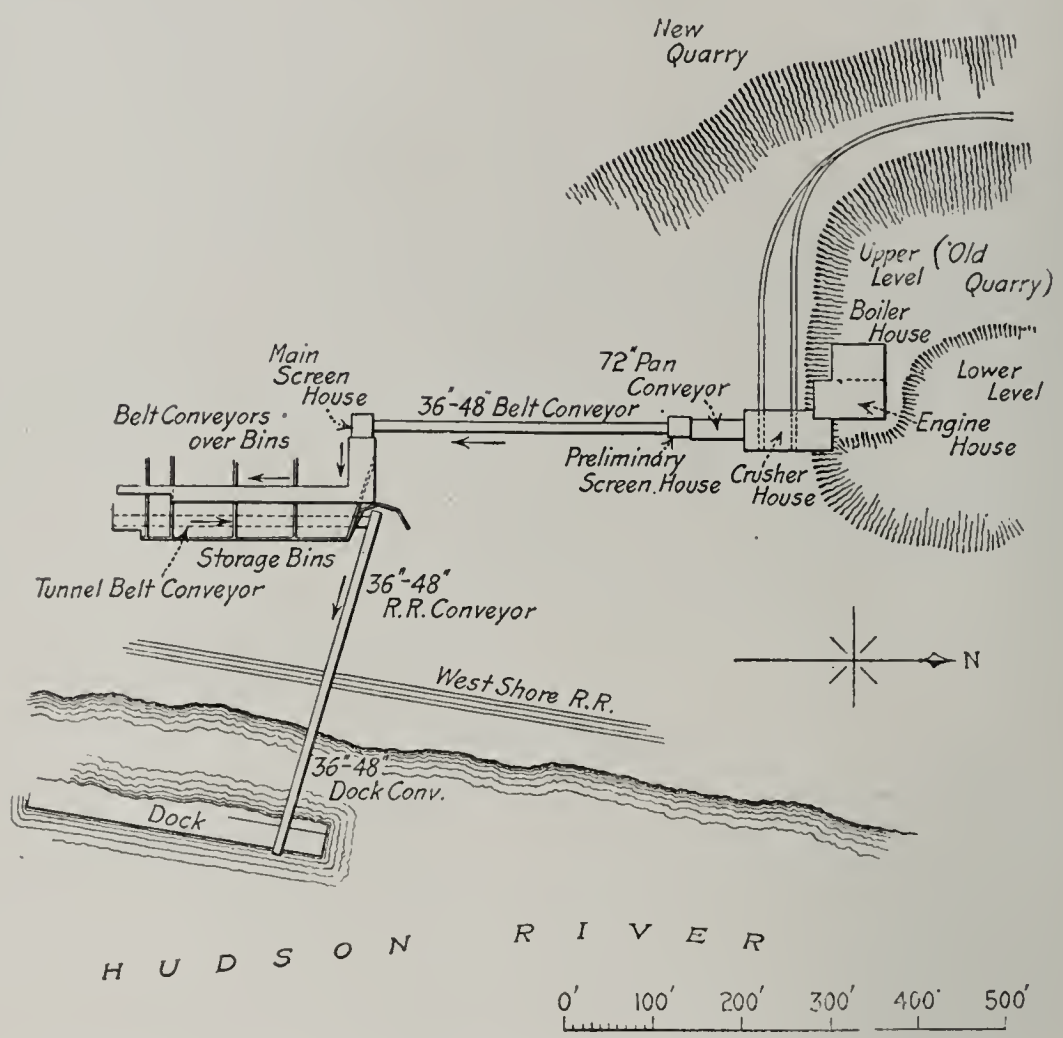
parts of the plant for the separate and independent operation of all the principal items of the machinery.

In order to pass the stone by gravity through the sets of crusher rolls, the latter are arranged in a vertical line between the levels of the floors of the second and third benches of the quarry. The skip dumping machinery and the lubricating oil reservoir are located

side of the opening in the feed tube, and a pair of full length distributing rolls 30 in. in diameter are placed in the bottom of the receiving hopper to deliver its contents more uniformly to the second pair of rolls 13 ft. vertically below the first pair, which are 4 ft. long and 4 ft. in diameter and of similar construction to the first pair. They are arranged to deliever to either

of two pairs of finishing rolls several feet below them, which are 4 ft. long and 3 ft. in diameter with corrugated surfaces instead of spurs. Only one pair of the corrugated rolls has been installed, but provision is made for the installation of a second pair if necessary, thus making the plant symmetrical and delivering broken stone on both sides of the center line to the pan conveyor.

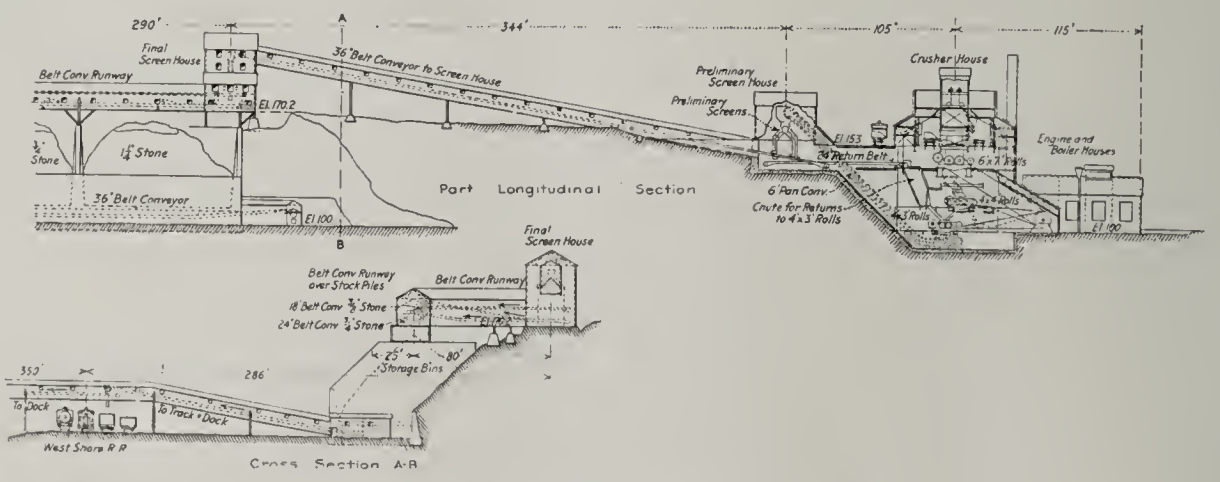
structed, with 116, 72 x 30 in. riveted steel triangular pans 2 ft. deep, with a capacity of about 1,000 lb. each. This conveyor is operated by a 150 H. P. motor at a speed of 87 ft. per minute and carries 1,000 yds. of broken rock per hour. All the other conveyors, which with this exception are of the belt type, are operated by separate electric motors.



Plan View Showing the Relative Location of Quarry, Crushing Plant and Docks.

The rolls are enclosed in riveted steel hoods hinged on their upper edges and lifted by tackles provided for the purpose. All of their bearings are flooded with oil in dust-proof iron boxes and the oil from a 500 gallon reservoir in the roof of the building is distributed through pipes and sight feeds to the bearings and collected from them in pipes which deliver to a 600-gal.

The pan conveyor discharges into the hopper of a fixed gravity screen which separates the broken stone into two sizes, one of which contains pieces above 1½ in. and the other contains everything below 1½ in. These screens have a number of comparatively long and narrow inclined shelves over which the broken stone falls in a sort of cascade with its velocity checked



Sectional View of Various Parts of the Plant.

drain tank in the basement. From this tank the oil is forced by a Davidson vertical triplex pump through a filter and back to the roof tank, thus providing for constant circulation and purification of the oil at a minimum loss.

The product of the rolls is elevated 83 ft. by a 45 deg. pan conveyor, said to be the largest yet con-

at each step, so that all of the screens are efficient.

The screens are arranged symmetrically inside a steel plate shell, and the two sets, each with a total area of 96 sq. ft. are separated by a central vertical diaphragm enabling either or both sides to be used at will. The removable screen plates, 2 ft. wide, are made in sections 4 ft. long, of thin carbon steel plates

punched with square holes and are set at an angle of about 40 deg. with horizontal.

The efficiency of the screen is very sensitive to changes in the character of the material or in the amount of moisture which it contains and to the inclinations of the screen; therefore the plates are made adjustable by the insertion of shims up to ½ in. thick under the lower edges. Extended experiments were made before the installation of this screen and resulted in the determination of the angle above mentioned which will probably be maintained, although the provision here described permits it to be quickly and easily changed if necessary. The screen plates are of commercial manufacture and can be quickly replaced when necessary, but they show such durability that it is believed that the use of ordinary steel will be continued instead of manganese steel, which would cost about four times as much.

The material passing over the first screen strikes a right-angle steel shelf just below it and covers the same with a cushion of broken stone which protects the surface of the steel and soon acquires a permanent slope on which all the succeeding material stops and then falls again to the next screen, from which it is deflected to a second shelf, and so on, this stopping at every step and zigzagging down from top to bottom at a moderate velocity.

The large stones rejected by the screens are discharged from their upper surface to a 24-in. belt conveyor 92 ft. long, driven by a 10 H. P. motor, and are returned to the finishing rolls.

The remainder of the stone, passing through the screens, is caught on an inclined bottom plate provided with transverse angles which check the speed of the stone sliding down over it to a second chute delivering to a 36-in. belt conveyor 36.2 ft. long that is inclined about 10 deg.. to the horizontal, driven by a 100 H. P. motor, and has a capacity of about 800 yd. per hour. It discharges its burden to the receiving hopper in the top of the main screen house about 60 ft. above the point of delivery.

This hopper delivers to a distributor which is a steel plate box containing two inclined tiers of narrow horizontal shelves on which the broken stone falls and accumulates in full width heaps with sloping sides over which the succeeding stones slide and fall in sheets on both sides of each shelf equally distributing it in long rows on the screen plates below. The shelves, 3 ft. long and 12 in. wide, are provided with rack and pinion connections which give them horizontal motion in either direction so that they can be adjusted if necessary to suit changing conditions.

From the distributors the broken stone passes through an 8 x 12 ft. rectangular box about 23 ft. high in which there are installed, on each side of the center line, three successive sets of screens of the same type as those described in the preliminary screen house. The screens are symmetrical on each side of the center line and each half, having a total screening surface of 192 sq. ft., can be used independently of the other and is designed to be served by two belt conveyors on each side besides a fifth conveyor on the center line which receives the ¾-in. stones from the screens on both sides.

This method of screening is considered by the owners to be more rapid, efficient and economical than the use of revolving screens and is believed by them to possess a great advantage over that method in that much less dust is produced and the sharp corners of the stone are not broken off as is the case when it is revolved in a cylindrical screen. The screens are completely enclosed, they are made of commercial plates easily secured, replaced and adjusted, the installation is compact and convenient and most of the steel work excepting the screen plates is protected from wear by cushions of broken stone thus greatly increasing its durability.

The 1½, ¾ and ⅜-in. sizes of broken stone are respectively delivered from the screens to 30-in., 24-in. and 18-in. conveyor belts 120 ft. long on centers that are driven with a speed of 400 ft. per minute and discharge their burdens to corresponding horizontal 30-in., 24-in. and 18-in. belts, 140, 210 and 275 ft. long respectively, all of which are driven at a speed of 300 ft. per minute by separate 20, 15 and 10 H. P. motors. They are at right angles to the first set of belts and carried through an elevated gallery over the tops of the storage bin, about 65 ft. above its floor, discharging at any point of any bin by means of standard automatic trippers.

The storage bins have a common horizontal concrete floor 40 ft. wide and 292 ft. long. On it there are seated five reinforced concrete transverse partition walls 48 ft. high which separate it into an outside extension and four independent bins enclosed by a vertical wall 32 ft. high on one longitudinal side and by the vertically excavated rock face of the bluff on the opposite side.

The widths of the belts are proportioned to the different quantities of stone produced by the crusher, namely 56 per cent of 1½ in., 30 per cent of ¾ in. and 14 per cent of ⅜ in. As the demand for different sizes of stones varies with different seasons considerable flexibility is required for the storage system and one bin is reserved for 1½-in. stone exclusively, another for ¾ in., two for ⅜ in., which is more likely to accumulate, and one large bin nearest the screen house is kept available for any size required.

In the floor of each bin there is a row of 18 x 24 in. holes 10 ft. apart on center. Each hole is provided with a steel quadrant valve operated by a lever in the tunnel below. When stone is required for shipment, two valves are usually opened and discharge the stone on a 36-in. horizontal belt 291 ft. long, which is operated bya 50 H. P. motor and runs from end to end of the tunnel at a speed of about 400 ft. per minute with a capacity of 10 yd. per minute.

This belt delivers to an inclined 36-in. conveyor belt 170 ft. long run by a 50 H. P. motor at a speed of 350 ft. per minute which elevates the stone to a height of 27 ft. above the ground and discharges into a hopper with transverse chutes on both sides through which the stone may be loaded into cars on the railroad track below, and with a longitudinal chute through which; if the transverse chutes are closed, the stone may be delivered to the last conveyor, which has a 36-in. belt 240 ft. long run by a 50 H. P. motor at a speed of 400 ft. per minute to the end of the dock, where it terminates about 28 ft. above water level with a hopper provided with a telescopic steel chute 20 ft. in maximum length which can swing 180 deg., supported at the outer end by a boom and tackle and thus enabled to reach any part of the 500 or 600-yd. barges moored to the front or side of the dock.

WILLIAMS MILLS FOR CALIFORNIA

The Williams Patent Crusher and Pulverizer Company announces that its San Francisco representative has recently sold to the Southwestern Portland Cement Company of Los Angeles, Cal., one of their No. 7 Jumbo limestone crushers. This machine will take 6-inch stone, reducing it to about 1½-inch size and finer for the dryers in the raw end of the cement plant. It will have a capacity of about 250 tons per hour.

Full information regarding this type of machine, or other crushing and pulveribing devices, will be given on application to the company, Old Colony Building, Chicago.

New Universal Cement Plant

Construction work is now being actively carried forward on the new plant, No. 7, of the Universal Portland Cement Company, near Duluth, Minn. A crew of about 240 is now employed in the construction work and the installation of the equipment. It is confidently expected that this plant will be completed and ready to ship cement by the time the market opens up next spring.

This new plant of the Universal group is rated as a 4,000 barrel mill, or with a capacity of approximately 1,400,000 barrels annually. Both in the design and construction of the buildings, their location with respect to each other, and the installation of the mechanical equipment, the experience of this company at its other plants has been used as a basis for securing, so far as possible, every economic advantage.

The plant will, after the usual custom of the plants owned by the company, use blast furnace slag as its siliceous raw material. This will be secured from the new plant of the Minnesota Steel Company, which is now being completed about 1,500 feet distant from the cement plant. It will require about 450 tons of slag each day to keep the plant in operation. This will be taken direct from the blast furnaces.

The other raw material required, namely, limestone, will be brought in by boat, thus eliminating any quarry problems at the new plant. About 650 tons of limestone will be required each day, and as it comes in by boat, it will be stored at the docks of the Minnesota Steel Company or delivered direct by gantry cranes to the raw material building at the plant. This building is 144x190 feet in area and contains separate bins for each kind of material, including, beside the stone and slag, the coal, of which about 200 tons per day will be required to keep the plant in operation.

From the storage bins the stone goes through No. 6 Chalmers & Williams gyratory crushers for its preliminary crushing. These reduce the stone to a size of 1½ inch and under. From these crushers the stone is elevated to two dryers. These dryers were designed by the mechanical engineering staff of the Universal Portland Cement Company, and are 5½ feet in diameter and 60 feet long.

From the dryers the stone is elevated to hoppers over three No. 9 Williams hammer mill crushers, which reduce the material so that it will pass through a 20 mesh sieve.

Before going through this latter grinding process, however, the stone passes through a spout on which is located a 4,000 pound magnet, this magnet picking up any pieces of steel or iron that may happen to be in the stone.

After passing through the Williams mills, the stone is elevated to the weighing hoppers.

The slag passes through a somewhat similar process, being taken from the raw bins by bucket elevators and fed into dryers similar to those for the stone, then taken from the dryers to the hoppers above the ball mills for preliminary grinding, and then elevated to the scale hoppers. These ball mills, like the dryers and much of the other equipment about the plant, were designed by the company and made after their own plans.

From the scale hoppers the two materials are drawn out and weighed by automatic scales, also of the company's own design.

On being mixed in the proper proportions, the materials are distributed to seven tube mills, each 7 feet in diameter and 22 feet long, and each operated by a 250 horsepower motor direct connected. These tube mills revolve at the rate of 21 revolutions per minute.

The New Plant of Universal Cement Co., Duluth, Minn., Equipped with Three No. 9 Williams Mills; Chalmers & Williams Gyratory Crushers; 3 Raymond Mills; Sturtevant Crushers and Ring Roll Mills; Stroh Process Gears and Pinions.

The material is now ready for burning and is sent by elevators and screw conveyors either direct to the burner building, or to an intermediate storage. The principal purpose of this intermediate storage is to provide a sufficient supply ahead, so that the kilns may operate seven days a week, while the raw grinding crew will operate but six days.

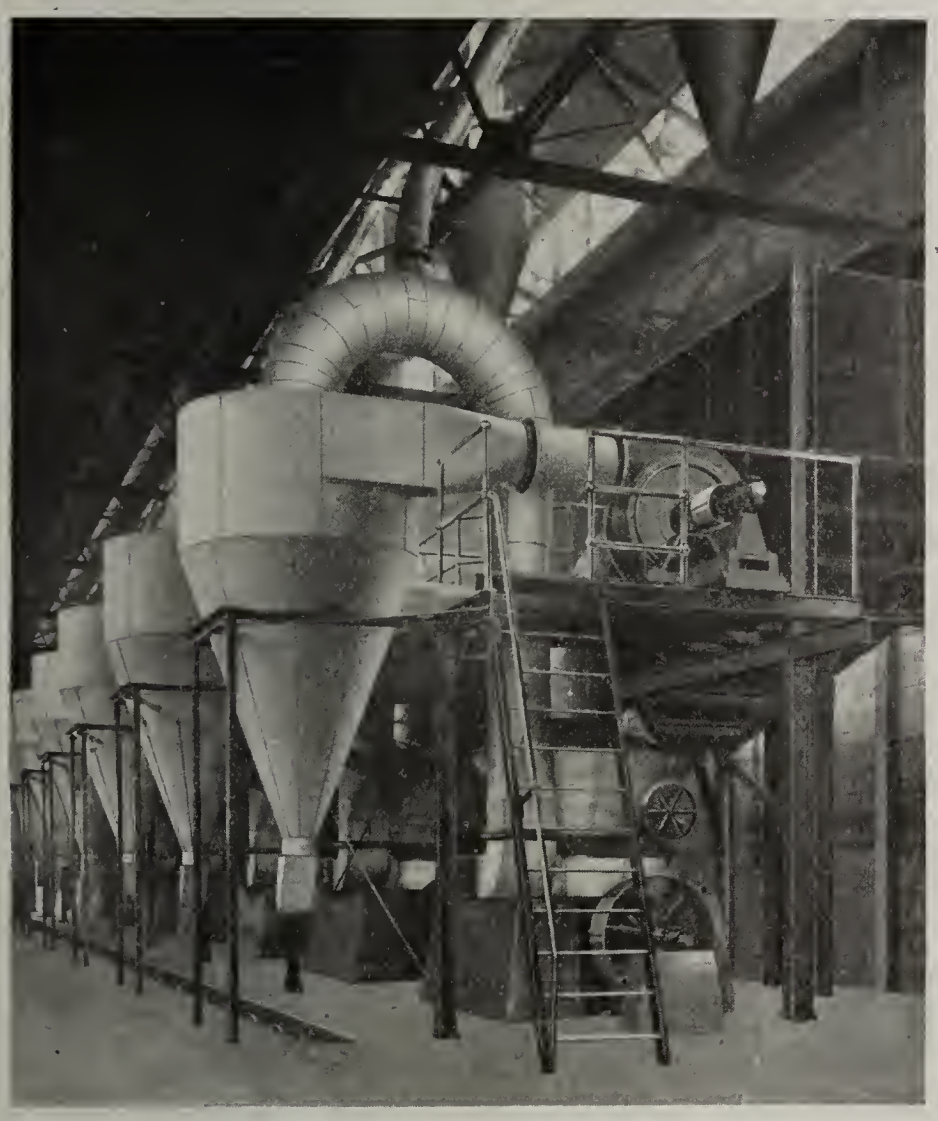
The burner building is 84x199 feet in size. From its hoppers the material is fed to four rotary kilns, also designed by the engineers of the Universal Portland Cement Company. These kilns are 10 feet in diameter and 150 feet long and make a complete revolution every 72 seconds. These kilns came to the plant in two sections, and after being placed by cranes on the bearings prepared for them were riveted together and lined with fire brick. Each of the kilns will be operated by a 35 horsepower motor.

Powdered coal is used for burning the mixture to incipient fusion in the kilns. The supply of coal as it comes to the plant is kept in the raw material bins, as previously stated, and at that point is fed into a preliminary hammer mill which reduces it to a size of ¼ inch and finer. It is then put through dryers, of

which there are two, each 5 feet in diameter and 50 feet long, after which it is then taken by Raymond impact pulverizer mills and reduced to a fineness sufficient for rapid ignition when it is blown into the kilns. There are a total of three Raymond mills for grinding coal in this plant. The Universal Portland Cement Company has had a wide experience in its plants with the Raymond Pulverizing Air-separating system as well as with many other types of equipment designed for fine grinding and they purchased the Raymond mills only after they had made a complete and thorough analysis of the service records of Raymond mills in comparison with all similar equipment in their plants. The decision was consequently made in accordance with the actual showing of efficiency and economy established by Raymond mills in the Universal Portland Cement Company's own plants.

In addition to its use in the kilns, powdered coal is also used for heating the dryers.

After being elevated and spouted to the clinker storage the clinker is handled by two traveling cranes, each equipped with a 4 yard grab bucket.



The Raymond Pulverizing Air-Separating System in a Big Cement Plant.

The clinker storage bin is 100x405 feet in size. During the winter this bin will store the clinker, ready for the finishing mill to grind on the opening the following season.

The finishing mill occupies a building 90x165 feet. It will have a capacity for producing 7,000 barrels of cement per day. This larger capacity over the capacity of the kilns is to enable the plant to produce large amounts of cement during the busy season, from the clinker which has been stored during the winter.

After being deposited in the hoppers of the finishing mill, the clinker is carried to Sturtevant rotary crushers, in which it is reduced to a size of ¾ inch and finer; then elevated and fed to Sturtevant duplex ring roll mills, equipped with Newaygo separators.

At this point the necessary amount of gypsum to regulate the setting time of the cement is added, and it is then passed on to the 7x22 feet tube mills, where the final grinding is given.

From here it is taken to the stock house. It is of reinforced concrete, 100 feet wide and about 400 feet long. It comprises 27 circular bins, 33 feet in diameter and 50 feet high, with a capacity of 10,000 barrels each, and 14 intermediate bins, each with a capacity of 2,500 barrels.

The cement is drawn out by screw conveyors located in tunnels under the bins, and from this point is elevated to the packing hoppers.

The plant includes a sack storage and handling department, where all sacks are received, counted and stored. This building is 40x272 feet. There is also a machine shop, the main part of which is 80x180 feet, with a storeroom addition 50x112 feet; and there are numerous other minor buildings.

All of the buildings, except the storage building, which has been described as of reinforced concrete, are built of concrete blocks and structural steel. The concrete blocks used are made by the hydrostone process, a plant for their manufacture, as well as for the manufacture of the blocks for the buildings of the Minnesota Steel Company being located on the ground.

An especially attractive building has been designed for the company's office, though the erection of this building has not commenced. This office building will have a frontage of 68 feet and will be 40 feet deep. It will have a full basement and will be two stories high above it. It is expected in this building to show the architectural possibilities of concrete blocks, while the main buildings of the plant will show their value in the erection of structures for manufacturing purposes.

The plant is being equipped throughout with Stroh process gears and pinions, manufactured by the Kennedy-Stroh Corporation, of Pittsburgh.

The Universal Portland Cement Company will have its own transformer station. This building is 37 feet wide and 74 feet long. The foundations for the transformers are now being completed and the machinery is being placed upon it.

The plant will be equipped with fifteen 250 horsepower motors, also many motors of smaller size.

Many conveniences are being installed for the employees, including shower baths, porcelain wash bowls and provision for individual towels and lockers.—[Cement Era.]

SCREENING EFFICIENCY

"Screening efficiency is highest where the screen is exactly suited to its service. Our success in selling screens for stone and gravel plants has followed our ability to design and manufacture the screen best suited to the work, under all circumstances. In our new steel shop we are prepared for more work with better delivery," writes the Jeffrey Mfg. Co., 914 N. 4th Street, Columbus, Ohio. "We build screens of all types and sizes to meet every working demand. We have made a special study of different screening conditions and of the various types of screens, best adapted to every service. Substantial design and construction are the essential features of our screens. Let us quote you on your requirements, or advise you of the proper screen to meet your demands."

Fig. 1—Reinforced Concrete Arch Bridges near Rhodes, Ia., C., M. & St. P. Ry.

Fig. 2—Framed Abutment of Reinforced Concrete, C., M. & St. P. Ry.

Unusual Concrete Structures Built By Railroads

Description of a Concrete Arch Bridge, Framed Abutment, Concrete Dam, Crane Runway, Oil Tank Guard and a Reinforced Concrete Signal Tower.

By A. M. Wolf, C. E.

The popularity of concrete as a material for the construction of railroad structures is emphasized by the great number of structural types which have been adopted as standard by various roads. It is also still further emphasized and the confidence which engineers place in it put beyond the question of a doubt by the many unusual and sometimes unique structures which have been erected.

It is the purpose of this article to illustrate and briefly describe some concrete structures which, although they may be unusual at present, will no doubt become standardized as have such structures as piers, ordinary gravity abutments, culverts, bridge floors and trestles. The growth of the concrete industry has been, and is at present, of such a rapid character that things which today seem unique are soon matter of fact and commonplace. It therefore seems well to occasionally leave the "beaten paths" of standard practice and treat of structures which will be fit subjects for further study and standardization.

Clear Creek Arch Bridge, Near Rhodes, Ia., C., M. & St. P. Ry.

The reinforced concrete double track arch bridge over Clear Creek, near Rhodes, Iowa, C., M. & St. P. Ry., is unique in that it represents the combination of the open spandrel arch and the framed concrete abutment which provides an unusually large waterway for a relatively small arch span.

The entire structure is of reinforced concrete, the main arch having a span of 60 feet. A bridge of this type is especially adapted to locations in high fills where ordinary gravity abutments would be uneconomical on account of the large earth pressures which must be resisted. In an open abutment the earth slopes down unhindered to its natural angle of repose and throws very little or no load upon the structure.

This bridge was built in connection with the second track and grade revision work recently completed on the Chicago & Council Bluffs division in Iowa. The accompanying illustration (Fig. 1) shows a party of draftsmen of the engineering department while on a tour of inspection of the structures they had designed.

Framed Abutment, C., M. & St. P. Ry.

The accompanying illustration (Fig. 2) of a large framed abutment for Bridge Z-814 on the C. & C. B. division of the C., M. & St. P. is interesting on account of the size of the structure and the economy of the type, which is apparent at a glance. An ordinary gravity abutment to retain a fill of such height would be a costly proceeding, to say the least, and if the same amount of additional waterway was provided as this abutment affords the cost of the steel work would be further increased.

Fig. 3—Concrete Dam, Creekside, Pa., Reservoir, B. R. & P. Ry.

Concrete Dam, Creekside, Pa., Reservoir, B. R. & P. Ry.

The use of concrete dams for impounding reservoirs for water supply of railroads is somewhat out of the ordinary, it generally being considered too expensive. The dam illustrated in Figure 3 is constructed of plain concrete with overflow apron with sidewalls to restrict the water to the apron. The gate-house shown in center of illustration is also of concrete. The dam was built by the B. R. & P. Ry. at Creekside, Pa., for terminal water supply some distance away.

Concrete Crane Runway for Cinder Pit, B. R. & P. Ry.

In connection with the construction of a large concrete roundhouse at Du Bois the Buffalo, Rochester & Pittsburgh Ry. has constructed a reinforced concrete crane runway for traveling crane operating over a cinder pit.

The runway shown in Fig. 4 consists of two lines continuous concrete girders carried on buttressed col-

umns, the traveling bridge crane spanning three tracks. The crane rails are anchored directly to the concrete girders.

Fires in cars at cinder pits are by no means uncommon occurrences and a fireproof crane runway is free from danger of damage by such fires. The maintenance cost of a structure of this type is practically nothing and it compares favorably in first cost with a structural steel runway.

Fig. 4—Concrete Crane Runway, DuBois, Pa., B. R. & P. Ry.

Guard Wall for Oil Tank

Many of our western roads use oil for fuel for locomotives. This oil is ordinarily stored in large steel tanks and in order to protect an oil tank from fire and loss by leakage one road has built a reinforced guard wall 15 ft. high and 1 ft. thick around the same. (See Fig. 5.) The area enclosed within the wall is covered by a concrete floor slab, forming with the wall a secondary retainer for the oil in case of damage to the steel tank. This structure then guards both the interests of the railroad and the people living nearby who might suffer loss in case the tank should break and the oil be set on fire.

Fig. 6—Concrete Signal Tower, B. R. & P. Ry.

Reinforced Concrete Signal Tower, B., R. & P. Ry.

Concrete signal towers are being used quite extensively by eastern roads and have become quite common in some localities. The tower illustrated here (Fig. 6) is of unusually fine architectural design, the general motif being particularly adapted to concrete.

Towers of this type have been adopted as standard by the B., R. & P. Ry. and several have been built at comparatively low cost. In one instance the entire cost of tower, including a 36-lever machine, was about $3,200.

The tower with exception of roof is of reinforced concrete with wooden window frames, sash and doors, and a steel stair to observation room at the back of tower. The roof is of timber construction covered with Imperial Spanish tile. The use of large recessed panels with elliptical heads in sidewalls and corresponding shaped heads for large windows does much to enhance the appearance of this beautiful structure. The

Fig. 5—Concrete Guard Wall for Oil Tank.

circular windows in the front and the heavy coping at sill line of upper story windows are architectural details which add little in cost but much in appearance.

One sees concrete signal towers in which absolutely no attention has been paid to architectural treatment and as a result the building is almost an eyesore to the station grounds instead of an ornamentation, as it should be. A building of the kind here illustrated costs only a small amount more than a merely utilitarian structure and from an architectural standpoint the extra expenditure is warranted by the results obtained.—(Railway Engineering.)

PROFITS IN MODERN BLOCK WORK

If the concrete block manufacturer wants to prosper, he must secure for his product the indorsement of architects and builders. To accomplish this, he must not only make a hard, waterproof block, but he must produce a block that will be pleasing to the eye and be conformable to the general scheme of architectural design.

Experience with Concrete Protected Timber Piles

In Tropical Waters, at San Juan, Porto Rico.

BY J. P. CARLIN, C. E.

The consideration of some material, with which to permanently protect timber piles against Teredo and Limnoria, has occupied the time and attention of a great many engineers. An effort has been made to accomplish this result by creosoting piles; but experience has shown that, in some of the southern coast states and in the tropics, notably on the Pacific Coast, such treatment but slightly increases the life of a timber-pile. Experiments have been made, especially in the West Indies, in which terra cotta pipe, similar to sewer pipe, has been placed over the pile in the water, and the space between the terra cotta and the wood pile filled with sand or mortar. Also hollow cylinders of reinforced concrete have been made to slip over piles, already driven; and the space between this protection and the solid timber filled in a similar manner. It is obvious that a ship, or any other obstacle, striking against such a protection would crack or shatter it; and, hence render it unsatisfactory for the purpose intended.

On the Pacific Coast, Messrs. Lilley and Thurston of San Francisco, developed what they call a "gunite" coated-pile. This consisted of wrapping an ordinary wooden-pile, for a distance to be exposed to the water, with wire mesh secured by staples, or otherwise as shown in Fig. 2. Upon this mesh reinforcement was placed a coating of cement mortar applied under air pressure and by means of a cement gun. In their experiments, the thickness of this coating, including the reinforcement, was about one inch or one and one-eighth inches, and it appeared that satisfactory results were obtained. When the contract for the construction of the San Juan Bulkhead, in Porto Rico, was awarded to the P. J. Carlin Construction Co., it was determined to give this "gunite" coated pile a trial. The plan for this work was made by Mr. H. C. DeLano, C. E., who had probably more experience in tropical dock building than any other engineer in this country—gained chiefly in the Philippine Islands for several years, and also for some years in Porto Rico. He was also familiar with the various types of sea-wall construction about the harbor of New York, having been identified with the New York Dock Department as Construction Engineer, which department is a recognized authority on sea-wall construction by virtue of its experience in the building and maintenance of these standard sea-walls.

Mr. DeLano's design for Porto Rico included the best features of sea-wall work extant, and also introduced new and important features with regard to economy and adaptability for tropical waters. He called it the "cantilever type" as against a heavy gravity wall, and it indicated a light, but substantial and inexpensive form of bulkhead which was to extend a distance of about 2,800 lineal feet, around the present shipping portion of San Juan harbor.

A section of the wall is shown in Fig. 1, and is extremely interesting and well worth adopting wherever similar conditions prevail. It is noticed that the construction involved a row of piles every twelve feet, placed at right angles to the direction of the wall. Each row is capped with a concrete buttress, and the buttress connected by longitudinal beams in the direction of the wall, with the beams themselves supporting the deck construction. Running from buttress to buttress, in the rear of the wall, is a concrete walling strip, with a similar wooden walling strip placed against the inner row of piles and at a depth below the water. Against these walling strips, tongues and grooved concrete, reinforced, sheet-piling was driven to retain the filling behind the sea-wall. The thrust of this filling against the sheet piling was transmitted to the buttresses, and in every buttress pier two batter piles were placed at an angle of approximately thirty degrees.

Preliminary borings had been made, and test piles driven, which indicated that piles of approximately fifty feet in length would be required, and that the driving would be comparatively easy for all but the last five feet. This fact is important, as it had a serious bearing on the use of a cement-coated pile, which could not have been foreseen. Undoubtedly, in the San Francisco experiment, it was either possible to get the piles into their final position, or else they were

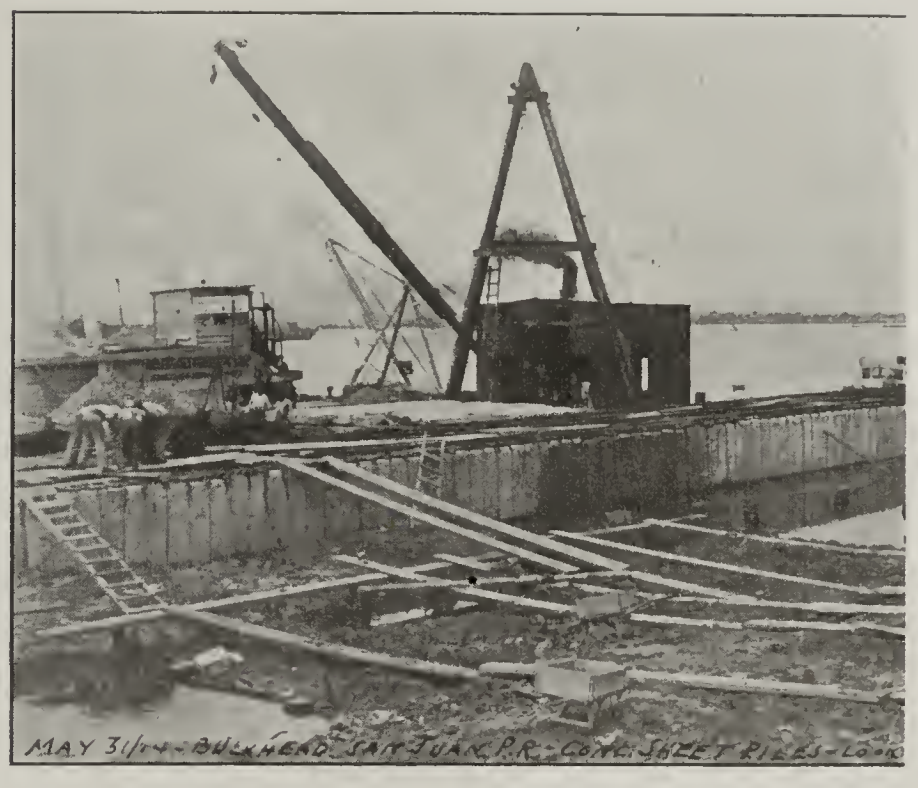


Fig. 1. Concrete Sheet Pile Bulkhead.

on lateral friction to sustain the load. It was also known that the so-called "Ripley" pile, which has a concrete casing rather than a cement coating, had developed a tendency to break off in hard driving; and, to overcome this, its promoters have used vertical reinforcing rods in addition to the spiral mesh reinforcement.

In the San Juan work, two thicknesses of metal fabric were spirally wound about eight ¼" rods (held by a staple) and running the length of the coated pile. The thickness of the "gunite" material was also increased from 2½" to 3". A number of these coated piles were prepared, kept wet for several days, and allowed to set for at least thirty days before driving. After they were coated, these piles apparently showed no indication of surface cracks; but, when they were moved and handled, owing to the additional weight of coating (about 2½ or 3 tons), it was noted that the underside of the pile, where it had sagged between supports, showed hair-cracks; and, when the pile was revolved through 180 degrees, new hair cracks developed on the then underside. It is thought, also, that some cracks may have developed in the process of coating the pile, because of the manner in which the pile was carried on roller supports, placed about forty feet apart. As the material is shot on to the reinforcement by

the cement gun, the building-up process is gradual over the whole length; and the pile being rotated, it sags toward the underside as the weight is increased. Consequently, little cracks are made before the initial set is obtained; and, in taking them off the roller by the use of a derrick and transferring them to the place of seasoning, other cracks must develop.

However, whatever the cause, when these piles were put in the leaders of the pile-driving machine and subjected, first to a drop-hammer, and later to a steam-hammer, manufactured by Union Iron Works, Hoboken, N. J., the cracks appeared to open; and, in some cases, large pieces of cement coating fell off, exposing the reinforcing. This did not occur until the piles reached the final 5-ft. stage of driving; here they encountered a stratum of clay, into which it was necessary to go at least 5 feet, especially in the case of the batter piles, otherwise the points would slip and would not sustain the thrust of the backfill against the wall.

Fig. 2. Reinforcing on Timber Pile.

This required such severe driving that many of the piles were damaged; the great cost of making these repairs under water therefore made the method prohibitive, and recourse was finally had to the solid concrete piles.

It may be of interest to explain the method of repairing the damaged cement coated piles under water. This was done by putting on a steel cylinder, about six inches larger in diameter than the coated pile, and around the part of the pile to be repaired. All joints were closed and the bottom of the cylinder was made to fit close to the surface of the pile, with the top of the cylinder open. On the deck, above the pile to be repaired, a tank was set up, with a large valve connected to a piece of 1½″ single ply cotton hose, leading down to the bottom of the space between the pile and the cylinder. Cement grout was mixed in the tank and allowed to run down the hose, a diver keeping the lower end of the hose below the surface of the deposited cement until the top of the cylinder was reached. The cylinder was allowed to remain on for two or three days, then it was taken off and transferred to another pile to be repaired. The results were considered very satisfactory.

It is believed that if some method of rotating the pile, without sagging, during the application of the "gunite" can be devised, and also of handling the pile from the rollers to the seasoning yard, that this method can be satisfactorily, and of course, economically employed. It is undoubtedly less expensive than the solid concrete pile, as the coating of 2½″ thick, including overhead, and all costs, except plant, up to the time of driving amounted to about 80 cents per lineal foot of pile coated. This would make a 50 ft. bearing pile, coated 25 feet, cost about as follows:

50 ft. timber stick ready for coating @ 20 cents per foot	$10.00
25 ft. of "gunite" in place @ 80 cents	20.00
	$30.00

Unit 50 ft. pile cost ready for driving or per lineal foot 60 cents.

The plant equipment cost about $2,000 and for 2,000 piles made an added plant cost of $1.00 per mile, or 2 cents per lineal foot.

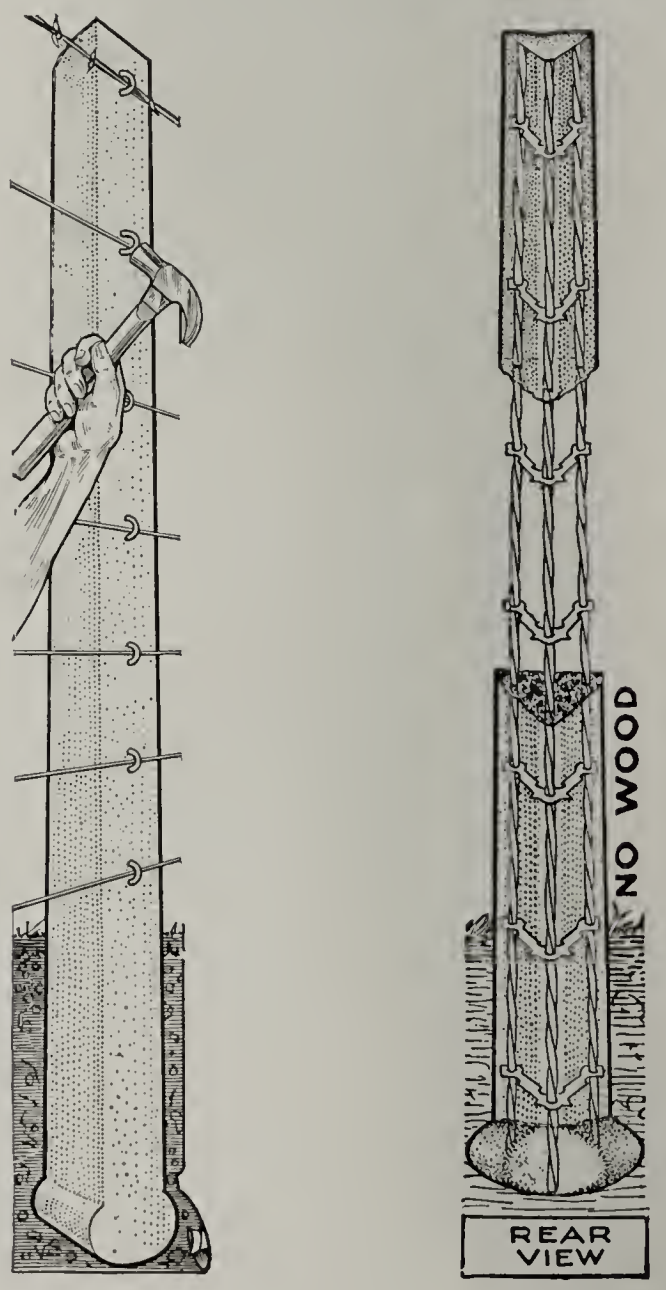
Thus, the total cost per lineal foot of the timber "gunite" protected pile was about 62 cents, as against a cost of $1.00 per foot for solid concrete piles of the same dimensions and of the same carrying capacity.

The writer feels that a coating of about 1¼″ would be very much better than 2½″ because it reduces the weight on the wooden-pile, and it sufficiently covers the reinforcement. A marine-borer cannot get through one-eighth of an inch of cement-mortar, but more than this is necessary to protect the reinforcement and to prevent "flaking" of the mortar.

CONCRETE POSTS INTO WHICH STAPLES CAN BE READILY DRIVEN

Concrete posts into which staples can be readily driven are made by the system patented and sold by the Staple Post Mold Company, 454 W. Home street, Westerville, Ohio. Mr. R. B. Bennett, secretary of that company, is the inventor of this system.

Mr. Bennett says he has found that the use of light wire and hoop iron, with the idea that anything will



do for reinforcement, has given the post business a black eye in some localities. His slogan is, "Make a good post and the post will make good."

In the staple post there are three ¼-inch twisted bars, tied and spaced at every foot by the Bennett steel core plate. The twisted rods come out to the exact length from the mills.

Another unique feature of the Bennett post is the method of fastening the fence wire to the post, as above suggested. At the time the post is made, Mr. Bennett molds a special stapling composition in a streak down through the face of the post, into which staples and nails can be driven at any time, regardless of the age of the post. This composition contains no wood, will not deteriorate, and is everlasting. The staples can be withdrawn and new ones driven in the same place, or above or below, as may be desired. This composition does not add one-tenth of a cent to the cost of the post and each purchaser of the molds is given full instructions as to how to make it.

THE ELECTRIC DRIVE OF CONTRACTORS' MACHINERY

The electric motor is being used more extensively every year for operating contractors' machinery, such as hoists, concrete mixers, crushers, pumps, air compressors, drills, shovels, drag line cableway excavators, etc.

The main reason for this growing popularity is simply that electric drive is more economical and convenient than steam, provided, of course, electric current is available, as it usually is in the neighborhood of built-up communities.

In the first place, the motor does away with the steam engine and the boiler. This means that there is no fuel or water to handle, no licensed engineer is required, and smoke and sparks are eliminated. One man only is required to handle a motor-driven machine, and he need not be an experienced engineer, as any workman can learn to handle a motor in a short time. A single handle controls all operations, starting, stopping, reversing, and changing the speed. There are no stand-by losses, either. The motor uses power only when actually running, and when at rest involves no expense whatever.

Having no boiler, the machine is lighter and more compact than a steam driven machine, and hence is more readily moved and placed in position. On account of its compactness, a motor-driven hoist may be placed where it will not interfere with traffic. The absence of fire and sparks makes it absolutely safe even though it is crowded under the scaffolding. Cables located overhead out of the way take the place of awkward, leaky pipes, and there is nothing to freeze in cold weather. Delays while "steaming up" are done away with. The machine is always ready to start when the whistle blows.

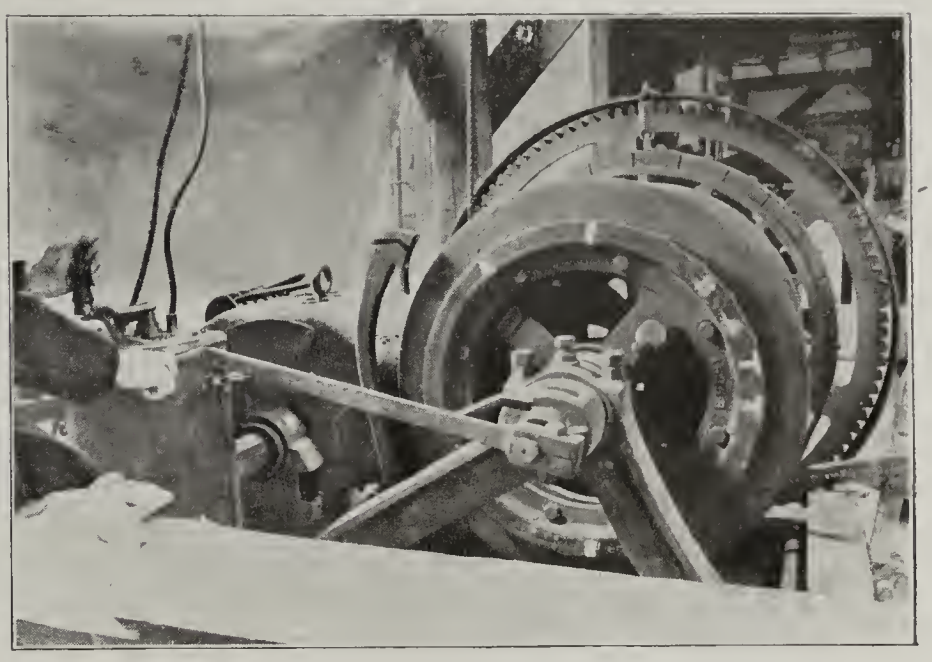
Another point in favor of the motor is its simplicity and reliability. Its motion is wholly rotary; there are no reciprocating parts and only two bearings, and these are self-oiling. In consequence, it needs little attention and has a very long useful life. The motor is also very quiet in operation, a matter of importance in doing city work where the noisy exhaust of a steam or gasoline engine is often objectionable.

The Westinghouse Electric & Mfg. Company has studied this field very carefully, and builds a line of motors specially adapted for contractors' use. Their special features are their ruggedness and strength to withstand the very hard usage to which they are subjected.

Motors for hoists, concrete mixers, and shovels may be totally enclosed. They are designed to produce considerable power within limited dimensions, especially in starting, where the demand for power is greatest. The speed is adjustable, and the motor can be stopped and reversed almost instantly without injury.

The extensive use of electric power in such operations as the building of the Panama Canal and the Catskill Aqueduct proves its desirability for large work, while a careful consideration of the advantages enumerated above makes it evident that it is superior to any other form of power for the small job as well as the large one.

The motor-driven hoist shown in the accompanying illustration, the photograph of which was secured with difficulty owing to the limited space, is located on the sidewalk at 5th avenue and 14th street, New York City, where it is in use in connection with repairs to a building. This is typical of the many uses to which electric motor hoist is applicable where the steam hoist would be unsuitable.



A REVOLUTION IN CONCRETE SILO CONSTRUCTION

Some ten years ago, Mr. Walter Polk of Fort Branch, Indiana, was visiting a friend in Evansville, Ind. This friend was erecting a concrete smoke stack and having a mighty hard time with it, experiencing the thousand and one difficulties that attend circular concrete construction, especially where altitude is necessary. Mr. Polk, seeing the difficulties, turned his inventive genius to the problem and before long had contrived the Polk system of circular concrete construction.

Just at this time an admirable opportunity offered to try out the new invention. A resident of Fort Branch, Ind., had decided to build a circular steel grain storage bin. Mr. Polk persuaded him to have it built of concrete and guaranteed the job. Erected by the new Polk machine, this concrete bin was an unqualified success.

Their machines for circular monolithic concrete construction have been in use only eight years, but already they are to be found in operation from New York to California, and from Montana to Eagle Pass in one direction, and to West Virginia in another. The machines are fully covered by patents in the United States and Canada. The basic principle is that of a hollow steel mast guyed to a perpendicular from which the steel forms are suspended. A filling of 3 ft. 10 ins. can be made every day. The highest circular concrete constructions in existence have been made by these machines, and there is practically no limit to the altitude attainable.

Sand Handling with a Drag Line Excavator

Gravel for Concrete Construction and Roads Produced Economically by This System.

The sand and gravel estimated produced in the United States during 1914 was over 79,000,000 tons, having an approximate value of $23,800,000.

Naturally, the cost of producing this vast amount of material is quite an item, and very often the speed with which it can be produced is an important factor.

Among the various kinds of equipment used with success for the work are the dragline cableway excavators, which, in general, consist of a guyed tower, or mast; a track or main cable attached to the top of the tower and anchored to the ground at a usual distance of 400 to 600 feet from the tower; a tension cable working through a set of fall blocks for raising and lowering the main cable; a scraper bucket suspended from the track cable, and an operating or pulling cable, by means of which the scraper is carried back and forth. The cables are usually controlled by a double drum hoist.

Shearer & Mayer Drag Line Cableway Excavator Digging and Conveying Material from the Bed of the White River.

Excavators of this type have been on the market for a number of years, but it has only been during recent years that they have reached the state of successful and general use.

The principal features claimed for dragline excavators for sand and gravel handling, aside from their cost of installation and operation, is that by one operation they do the digging and convey it to the screens or loading bins.

The accompanying illustrations show views of the gravel plant operated by the Frank H. Kent Construction Company at Columbus, Ind.

This plant consists of a 1¼-in. wire rope cable main line, 600 ft. long, furnished by A. Leschen Sons Rope Co., St. Louis, Mo.; ⅝-in. tension and loading lines; 1⅛-in. main guy cables; ⅝-in. auxiliary guy cables; a 1¼-in. bridle cable, and a 1-in. anchor cable for hoist. The power is a 40 h.-p. hoisting engine. The bucket is a Shearer & Mayer type of 1 cu. yd., manufactured by Sauerman Bros., 1139 Monadnock Block, Chicago. Mr. Kent writes Cement & Engineering News under date of December 15, 1915, regarding this bucket as follows:

"We have used several other makes of buckets and we desire to state that we are well pleased with the Shearer & Mayer bucket."

Automatically Dumping Gravel at the Washer—Frank H. Kent Company's Gravel Plant, Columbus, Ind.

The working capacity of this plant is approximately 250 yds. per ten-hour day, and all material is washed by a 5-in. stream of water, as it runs over the gravity screens. While this washing increases the first cost of the gravel, it is produced at about 4 cents per cubic yard.

This plant is now producing sand and gravel for the concrete streets and roads that the Frank H. Kent Construction company is building at Columbus. The material is obtained from the bed of the White River.

H. W. Caldwell & Son Co. of Chicago, announce the opening on January 1st of a sales and engineering office in Dallas, Texas. This office is located at 711 Main street, and is in charge of Mr. J. C. Van Arsdell. The company is planning by this new move to give even better service to its patrons in that part of the field.

The Zagelmeyer System of Casting Hollow Cement

Building Blocks with Granite Faces.

Producing an absolutely water-proof hollow cement building block with a sparkling granite veneer facing at a reduced cost of manufacture, made possible by casting the blocks from patented multiple molds, constitutes the Zagelmeyer System—the process that has revolutionized the cement block industry and is fast eliminating the old objectionable dry tamp method from existence.

low cost have won favor wherever used—the remarkable growth of every plant using our molds is proof sufficient that the Zagelmeyer System has solved the cement block problem, overcome all the defects of blocks made by other methods and placed the cement block among the foremost of building materials.

By the Zagelmeyer System, you can make water-proof granite veneered blocks, either smooth or rock

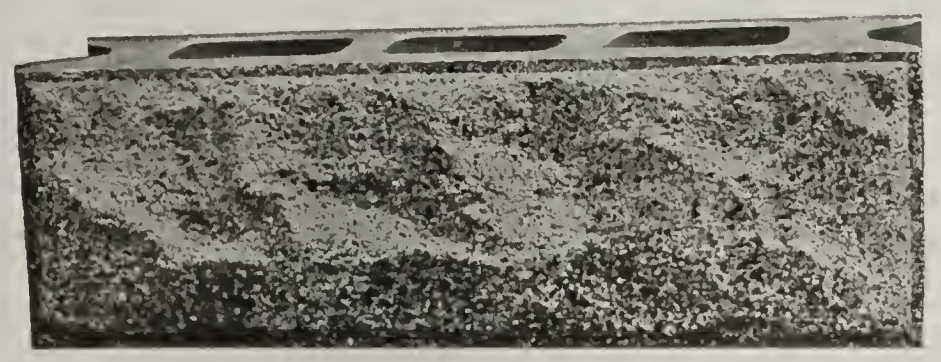
Concrete Block Residence of Zagelmeyer Waterproof Hollow Cement Building Blocks.

The Zagelmeyer System affords positive protection to block makers securing Zagelmeyer casting molds and territorial manufacturing process rights to enter a profitable business without fear of competition; enables you to turn out a more superior product than is possible by any other method and at less cost, and furnishes you with a monopoly legalized by the United States Patent Office by which patent grants you can build up a protected business that will be highly profitable, writes Mr. Zagelmeyer.

The Zagelmeyer Cast Stone Block Machinery Company not only manufactures the machinery and molds necessary to cast water-proof granite veneered cement blocks, but also operates the two largest cement block manufacturing plants in the world. Being pioneers in the business and having experienced a wonderful yet natural growth in production volume at both our large Bay City and Detroit block plants and having watched, analyzed and studied the growth of demand for a building block that was practical as well as possessing superior appearance, we cannot help but feel qualified to successfully guide and advise others desiring to follow our methods.

There is no question, whatsoever, as to the permanency of the steadily increasing demand for Zagelmeyer granite faced blocks. Their beautiful appearance, great strength, imperviousness to moisture and faced, at less cost than you can turn out an inferior block by any other process—you can sell them for more and, by reason of their greater strength, durability, quality and adaptability to many new construction purposes, you can sell more of them.

You can obtain the exclusive right to manufacture these blocks in your territory—we give you absolute protection against competition and you can build up a business without fear of cut prices putting an end to your enterprise. Only in the Zagelmeyer System will you find a guarantee like this. Ask us about our molds for making silo blocks. Send for catalog fully describing our system. Zagelmeyer Cast Stone Block Machinery Co., 25 Crump Ave., Bay City, Mich.



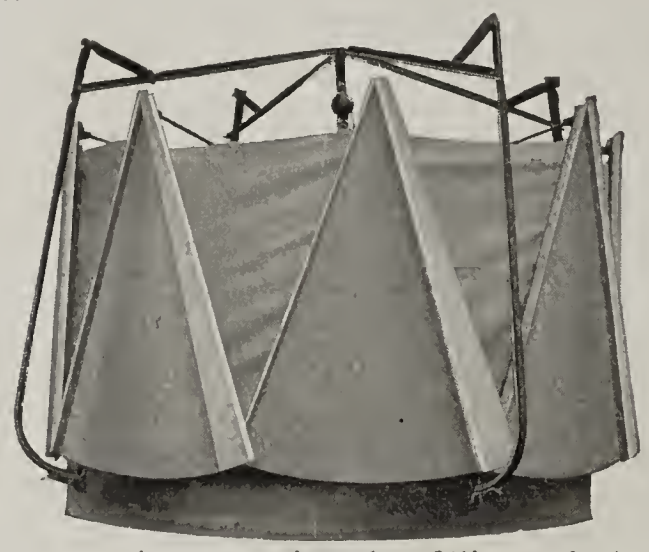
The Zagelmeyer Waterproof Hollow Cement Building Block with a Sparkling Granite Veneer Facing.

BUCKEYE EXTENSION SILO ROOFS

Every user of ensilage will appreciate the superior advantages of The Buckeye Extension Silo Roof, because it is the simplest and most efficient extension roof on the market today.

It is operated entirely from the ground by means of a rope running through a pulley at the top of the supports and can be opened or closed at any time by a boy standing at the bottom of the silo.

You can pack the silo from bottom to top at one filling and the roof closes with the shrinkage of the contents.



Its construction permits the filling of the silo to extend from 5 to 6 feet above the staves, this making ample allowance for shrinkage and avoiding the expense of a second filling.

The Buckeye Extension Roof is patented and has the unqualified endorsement of many satisfied users. It fulfills the proper functions of a silo roof in every particular with the added advantage of the extension feature. It is manufactured by the Thomas & Armstrong Co., 119 Main street, London, Ohio, who also manufacture a full line of Third pitch roofs, Gambrel roofs, metal chutes, steel ladders and ladder rungs. Write for descriptive circulars.

CEMENT COMPANY WILL BUILD HYDRATING PLANT AND BIG ELECTRIC GENERATING STATION.

John A. Miller of Nazareth, Pa., president of the Clinchfield Portland Cement Corporation of Kingsport, Tenn., writes as follows:

"In regard to our hydrated lime plant, this is designed to have a capacity of quick lime, or agricultural lime, or hydrated lime at the rate of 4 tons per hour, and in addition from 8 to 10 tons of ground limestone rock for agricultural use per hour. We hope to have this plant completed and in operation within about six months. The raw materials from which this limestone is to be produced are of the finest quality, and will produce a superior article.

"I might add that we propose to build and equip an electric power distributing station of from 7,000 to 10,000 kilowatt hours, the several large enterprises located in and around Kingsport having already closed contracts for the supply of current for their requirements. This development will take the form of an extension and enlargement of our present power plant, which supplies the current required in the operation of our own plant. The plans contemplate a plant of the most modern design, equipped with the latest and best power-generating machinery on the market, and it is proposed to have the work completed within about six months. L. L. Griffiths, our general superintendent, Kingsport, will be able to give detailed information regarding the lime plant, and, as soon as the plans are decided upon, regarding the power-plant development."

15 Years Of Truck Success

B. A. GRAMM
Originator of Gramm-Bernstein Trucks

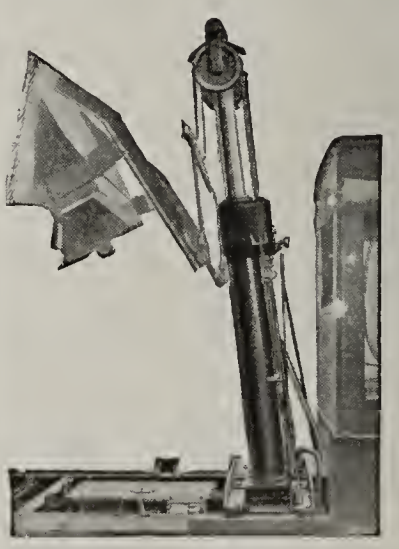
See Gramm-Bernstein Trucks at the Cement Show, Coliseum, Chicago, Feb. 12-19.

YOU insure yourself the utmost Efficiency — Dependability—Profit when you put Gramm-Bernstein Trucks on the job. In 15 years of manufacture, B. A. Gramm has worked out the *right* truck construction for *every* heavy duty. Put your transportation problem up to him. He will answer you personally.

GRAMM-BERNSTEIN
HEAVY DUTY TRUCKS

Prices (chassis painted to order) 5-6 ton, $4,300; 3½-ton, $3,400; 2½-ton, $2,600.
We also make lighter duty trucks, 1½-ton, $1,800; 1-ton, $1,500. Bodies built as ordered.

Write for illustrated catalog with full description of Gramm-Bernstein features. *Trouble-proof transmission guaranteed the life of the truck —gears always in mesh—cannot be stripped by most careless driving—worm drive —strength and power for great overload—simple control.*



Gramm-Bernstein hydraulic hoist. Quick dump and get-away. Operated from seat, dumping in 15 to 20 seconds. Material may be spread in any thickness while being dumped.

Ask for Book No. 5

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THE GRAMM-BERNSTEIN COMPANY
LIMA, OHIO, U. S. A.

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HIGH SPEED

Boss

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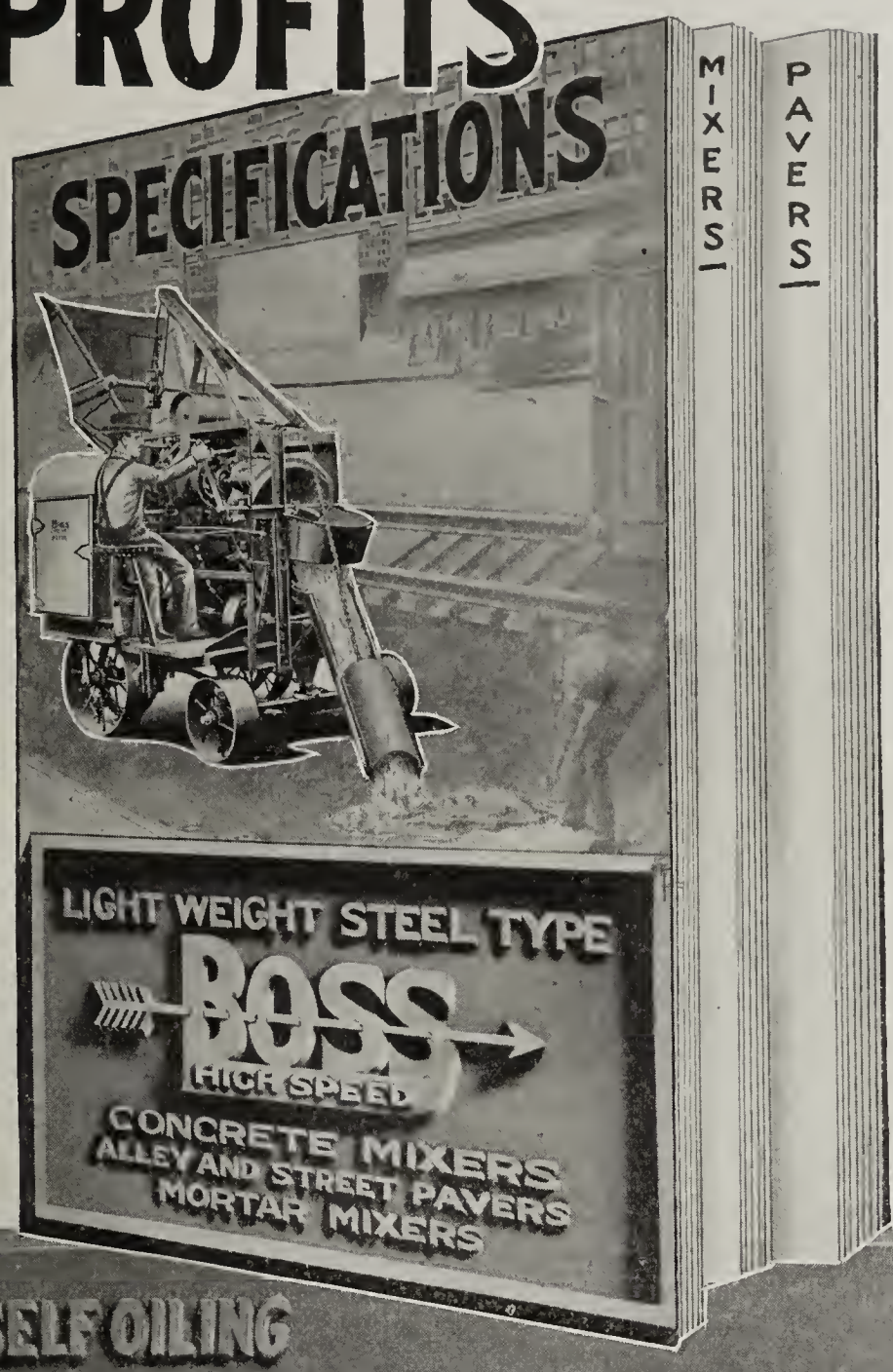
GUARANTEED TO MIX MORTAR



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GAS—STEAM—ELECTRICITY
5 Ft. LOW CHARGER
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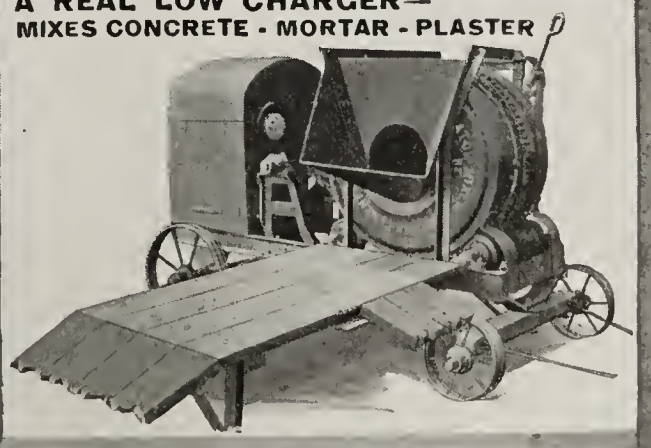

REPAIRING BUILDING SUPPORTS AND FOUNDATIONS WITH CONCRETE

A common source of annoyance and expense on the farm is the decay or giving way of building supports and foundations. When this occurs it is considerable trouble to replace these with new timber or ordinary masonry. It frequently happens that a building is in first-class condition while its supports have disintegrated or collapsed. For making repairs of this character concrete surpasses any other material. This is due to the fact that it is a plastic substance and may be molded or poured into recesses not readily accessible when another material is used. Timber supports may be renewed without jacking up the building beyond its original elevation.

For example, let it be assumed that a building is resting upon wooden or timber supports which have decayed at the ground level, which always occurs when timber is subjected to alternate wetting and drying. It is an exceedingly simple matter to remedy a situation

Fig. 1.

of this kind with concrete. One has merely to support the building with temporary struts, which should be placed near the post to be removed. The old post should then be sawed off entirely above the rotten part, the suspended part consisting of sound timber. Directly under this suspended post, dig a hole 2 feet deep and slightly larger than the post itself. Fill the hole with a mixture of concrete consisting of 1 part Portland cement, 2 parts sand and 4 parts stone. On top of this place a box with open ends, its inside measurement conforming to the dimensions of the hole. This box should be made and ready to use before any concrete is mixed or placed. Its length should be sufficient to reach from the ground to a few inches above the bottom of the sawed support. When in position, fill it with concrete until the bottom of the sawed-off post is imbedded about a half-inch in the concrete. Proceed as above with each support, leaving the boxes or forms in place for one week, and after two weeks the struts used as a temporary support for the building may be removed. The concrete should be mixed thoroughly wet and tamped or puddled with a stick while being placed.

In the case of large buildings elevated quite a distance above the ground, the new support or foundation may be made larger at the bottom than at the top by sloping one side of the box form, as shown in Fig. 1.

To Replace a Continuous Foundation with Concrete This can be done by the farmer with the help of his farm hands even where buildings are quite large and the foundation is of the continuous type, requiring jacking up of the structure. At necessary points remove a few heavy stones or bricks, as the case may be, and insert short pieces of heavy timber to wedge up the building. The building should be carefully raised by this means until entirely free from all foundation. Then remove all of the old foundation and set in place the forms for the concrete. In the case of small buildings it is usually feasible to raise them high enough to allow working room, in which case the form may be filled right up to the top with concrete. The concrete should be a wet mixture consisting of 1 part Portland cement, 2 parts sand and 4 parts stone.

Should the building be too large and heavy to be raised to a height that will give head room, merely make the foundations 3 inches wider than the sill. Then when the forms are carried to the desired height the concrete may be inserted through this extra space of three inches. To facilitate the placing of the first layers of concrete the top board of the forms may be left off until ready to place the last of the concrete. This last batch should be very wet. The concrete should be tamped until it comes up flush to the bottom of the sill and to the entire width of the wall.

Make certain that a space is left in the concrete wall under and on the sides of the underpinning support so that the building may be lowered onto the new foundation and the timber removed. This opening, of course, must be slightly larger than the underpinning support. The building should not be lowered until the foundation has been in place two weeks, and after this is done the openings occupied by the underpinning may be filled with concrete.

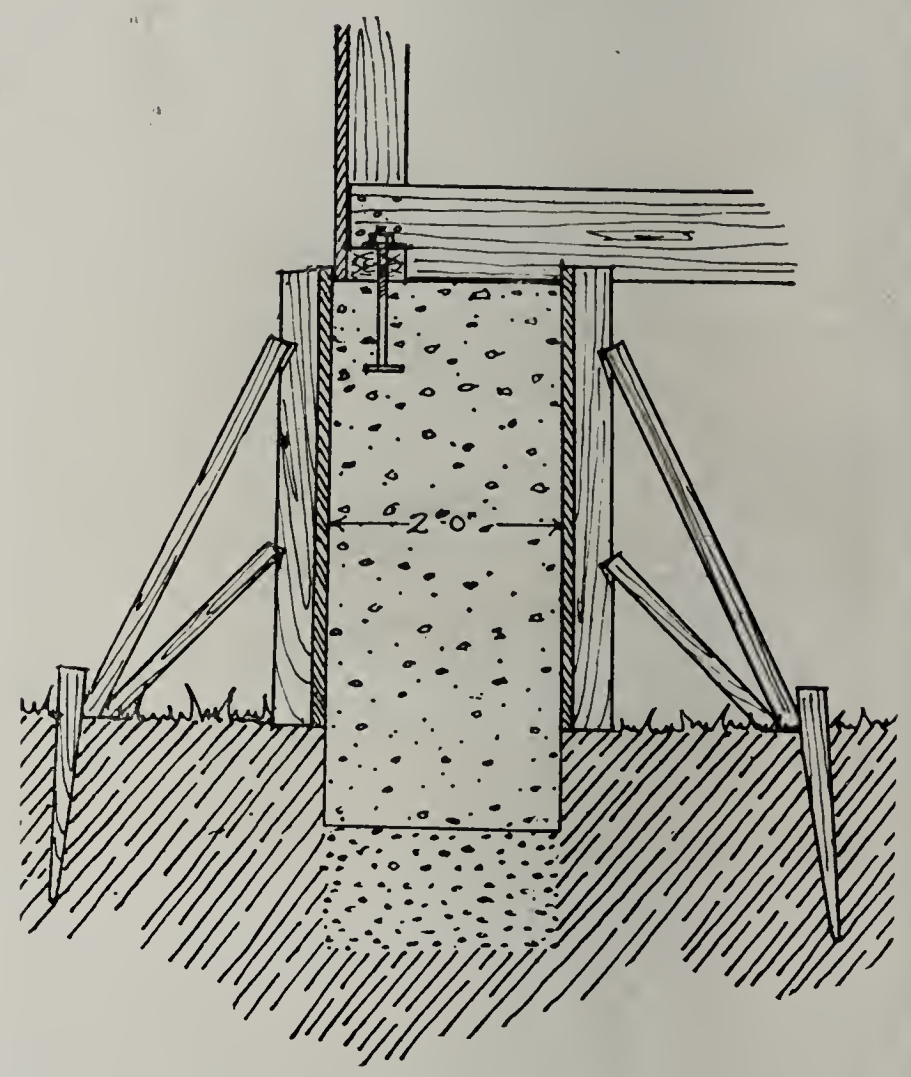

Fig. 2.

Fig. 2 shows how the forms should be constructed.

ACETYLENE-GENERATOR CELLAR OF CONCRETE

The acetylene generator used for furnishing gas for illuminating rural houses requires a safe, permanent location somewhat removed from the residence so as to minimize any danger from fire or objectionable odors. A concrete cellar located partly underground serves the purpose admirably. The cellar, when not used for housing the acetylene generator can be well

employed for storing combustibles, such as oil, gasoline, etc., or for the safe-guarding of farm explosives. The cost of such a structure is slight and it can be easily built by farm labor.

When deciding upon the size of the cellar it is well to make it large enough to contain the generator, its accessories and any other material that is to be stored therein. There should be provided also space for a box or container in which to dump the sludge or exhausted carbide from the generator. The cellar shown in the illustration is about 8 feet long by 6 feet wide and 5 feet deep below ground level, and has 6-inch walls. Note that the top is sloped for the purpose of shedding rain water. The door is carefully made and fitted to insure a perfectly dry cellar.

Construction of Cellar

Make the excavation 1 foot larger each way than the inside dimensions of the cellar and 4 inches deeper. This will provide for 6-inch walls and a 4-inch floor. If the earth is of a stiff character and will stand up no outside forms will be required below ground, the earth taking their place.

Before mixing any concrete have ready the inside forms as well as the outside forms for use above ground. These forms are made of 1-inch boards with tight joints.

The 4-inch floor should be first laid in the bottom of

Acetylene Cellar at Chalfonte, Pa.

the excavation. Concrete for the floor is proportioned 1 part Portland cement, 2½ parts sand and 5 parts crushed stone or gravel. As soon as the concrete floor is placed set the inside forms in position. While the concrete in the floor is still soft begin depositing the concrete for the walls between the inside form and the sides of the excavation. This concrete should be proportioned 1 part Portland cement, 2 parts sand and 4 parts gravel or crushed stone. The concrete should be well tamped and spaded into place. In doing this, however, care should be exercised to prevent dirt from falling from the earth walls into the fresh concrete as this would weaken the walls. Locate any pipes that are to run into the cellar at the proper points and place the concrete entirely around them where they pass through the walls. Continue depositing the concrete until ground level is reached. Now place the outside forms in position, staking them securely in place to prevent shifting. Continue depositing the concrete until the forms are filled. The top surface can then be troweled to a smooth finish and the concrete permitted to harden. The forms should be allowed to remain in place for two weeks before removing them. As the work progresses bolts for holding down the generator and hinges for the cover may be placed, heads down, in the fresh concrete. Concrete steps can be provided for entering the cellar, but it is usually the practice to provide only a short ladder for this purpose. The cover should be heavy, well made and provided with strong locks to prevent access by unauthorized persons.

A cellar of the size specified will require approximately 6 barrels of Portland cement, 2 cubic yards of sand and 4 cubic yards of stone.

THE BOSS 3,700-POUND PAVER

On page 57 is illustrated an up-to-date light paving mixer, which is sold at a startlingly low price. The machine is built of steel, resulting in a saving of over 2,000 pounds useless weight; a team moves the machine to any place. It has a short wheel base, with 28-inch rear, 22-inch front wheels, 5-inch tires, running in wagon track. Can be moved by hand or furnished with traction and steering wheel; equipped with Hyatt roller bearings, automatic power loader, new chain-tightening device, batch counter; in fact, every modern improvement.

The American Cement Machine Co., Inc., 9635 Johnson street, Keokuk, Iowa, the manufacturers, also build an 11-foot "Light" steam paver and the famous Little Boss line of mixers.

A LARGE SHARE OF
UNCLE SAM'S CEMENT
CROP IS NOW PACKED
IN

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BUT STILL THERE
ARE A FEW CEMENT
MANUFACTURERS
WHO MIGHT BE
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The Riegel Sack Company
WOOLWORTH BUILDING
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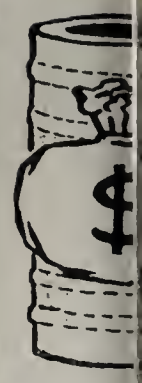
Cement Block Machine, $40.00

Makes three styles and all sizes Capacity 150 blocks daily. Special off-bearing system prevents cracking and breaking.

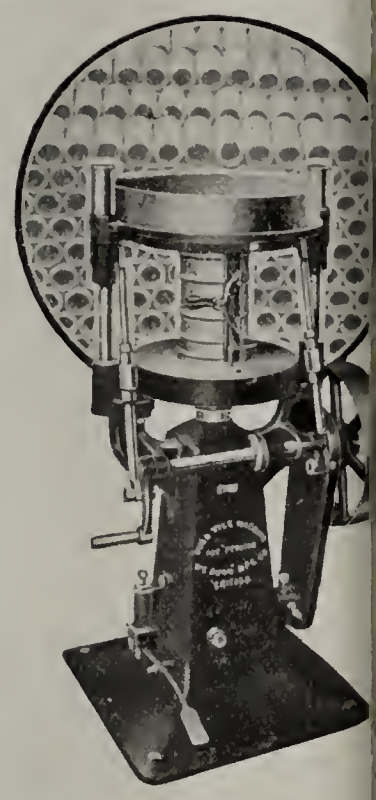
DRAIN TILE —a *Paying* Business



However you consider the tile business, IT'S GOOD. It is less of a gamble and more of a certainty than any branch of the concrete business.

Materials are cheap and abundant; manufacturing is simple; competition is not to be feared; the product is in great demand; the initial investment required is comparatively small; and **profits range from $230 to $800 a month—conservatively figured.**

These are straight-from-the-shoulder facts, without exaggeration or misstatement. If you want printed proof write for complete data.



Dunn No. 1 Ti Machine - $16

Capacity 1,500 to 2,(tile daily. Operated by 2 or 3 men. Makes sizes from 3"to 12" dia eter. Waist high tab triple-duty packer he No overhead frames or gle iron construction. working parts enclosed the massive one-pi base.

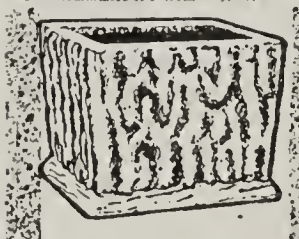
Concrete Vase Mold $15

Very attractive style of vase. Mold is simple to operate, neatly designed and accurately constructed. Two sizes. Fully described in Ornamental Mold catalog.

We Help You Get Business

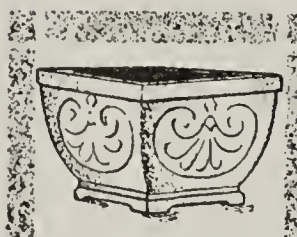
Here's our proposition: If you will promise to try out the tile business for two weeks, we will send a Dunn Machine and necessary equipment for you to use 15 days, absolutely without expense or obligation. Unless you convince yourself that cement tile is a good paying business, and the Dunn is a good machine, you may return the equipment and the trial costs you nothing.

Upon request we will send our Tile Machine catalog, full details on the tile business, and particulars on how we help you to success.



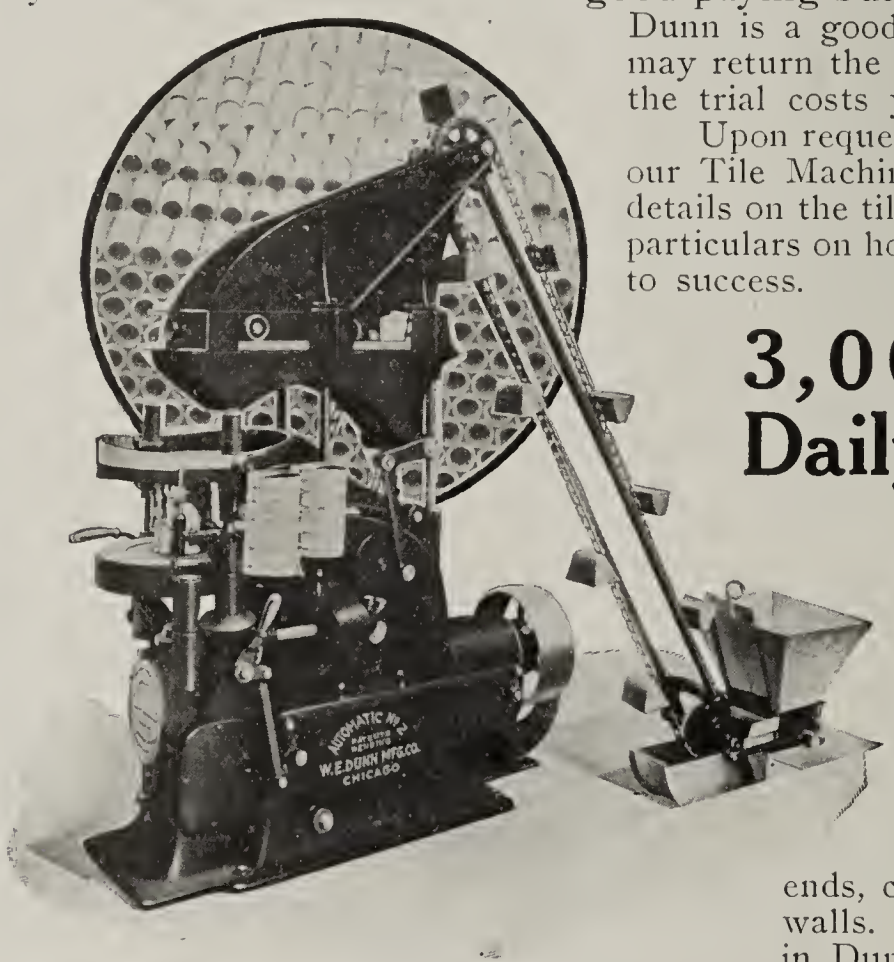
Concrete Rustic Flower Box Mold, $10

Attractive design. Made in several sizes. End and sideplates are interchangeable for the different sizes. Fully described in Ornamental Mold Catalog.



Concrete Flower Box Mold, $15.00

A very desirable and popular style. Very attractive for any porch, post, lawn, etc. See Ornamental Mold Catalog.



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Minimizes production cost makes the strongest, densest ceme tile ever produced. The logical m chine for an established tile busines Makes tile 3, 4, 5, 6, 7, 8, 10, 12, 14 a 16 inches in diameter, at the rate from 3,000 to 3,600 per day. Speci automatic features reduces labor cos

Equipped with the Dunn Tripl Duty Packer head which compacts t ends, cores out the center, and glazes the insi walls. Triple service of packer head is exclusi in Dunn machines.

Write for special catalog and prices on the Dunn Automa

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CEME SHO Chicago, Feb Space 130-1

Portland Cement Industry in 1915

An estimate of Portland cement production in the United States in 1915, just made by Ernest F. Burchard of the United States Geological Survey, indicates that the shipments from the mills amounted to 86,524,500 barrels, compared with 86,437,956 barrels in 1914, an increase of 0.1 per cent; the production was about 85,732,000 barrels, compared with 88,230,170 barrels in 1914, a decrease of 2.8 per cent, and the stocks of finished cement at the mills were about 11,583,000 barrels, compared with 12,893,863 barrels in 1914, a decrease of 10.2 per cent. The slight decrease in production and the considerable decrease in stock indicate greater caution in the industry, which in the preceding few years showed a tendency toward overproduction.

The Lehigh district, which produces nearly 30 per cent of the domestic cement, shipped 24,500,000 barrels, produced 24,860,000 barrels and stocked 3,460,000 barrels in 1915, showing increases, respectively, of 2.2 per cent, 1 per cent and 10.9 per cent over the corresponding totals for 1914.

New York State shipped 5,236,500 barrels, produced 5,097,000 barrels and held in stock 825,000 barrels. These figures represent decreases, respectively, of 4.3 per cent, 13.4 per cent and 15.1 per cent compared with 1914.

Ohio and Western Pennsylvania shipped 7,000,000 barrels, produced 7,200,000 barrels and had 750,000 barrels in stock. These estimates represent decreases of 0.9 per cent, 5.2 per cent and 33.8 per cent, respectively, compared with 1914.

Michigan and Northeastern Indiana shipped 5,545,000 barrels, produced 5,550,000 barrels and held stocks of 650,000 barrels. The first two quantities represent increases of 7.5 per cent and 6.4 per cent, respectively, and the third a decrease of 4.3 per cent.

Southern Indiana and Kentucky shipped 2,780,000 barrels, produced 2,840,000 barrels and had 490,000 barrels in stock, the first two quantities representing decreases of 5.2 per cent and 3.1 per cent, and the third an increase of 12.5 per cent.

The Illinois and Northwest Indiana district shipped 10,825,000 barrels, produced 10,200,000 barrels and had stocks of 1,511,000 barrels. These figures show decreases of 4.3 per cent, 11.6 per cent and 29.2 per cent, respectively, as compared with 1914. Iowa and Missouri occupied third place in 1915, with total shipments of 9,200,000 barrels, production of 9,250,000 barrels and stocks of 1,290,000 barrels. These figures represent increases of 3 per cent and 3.3 per cent, and a decrease of 12.4 per cent, respectively, as compared with 1914.

The Pacific coast district showed shipments of 5,867,000 barrels, production of 5,712,000 barrels and stocks of 880,000 barrels, or decreases of 16.8 per cent, 19.5 per cent and 11 per cent, respectively.

Cement plants in Kansas, Nebraska, Oklahoma and central Texas showed total shipments of 6,546,000 barrels, production of 6,378,000 barrels and stocks of 786,000 barrels, increases of 8.8 per cent and 2 per cent, and a decrease of 23.9 per cent, respectively.

In Colorado, Utah, Montana and Western Texas the shipments approximated 2,475,000 barrels, the production 2,525,000 barrels and the stocks 300,000 barrels, decreases of 10.2 per cent and 6.4 per cent, and an increase of 42.5 per cent, compared with 1914.

In the two southeastern districts excellent showings were made in the cement industry. In Maryland, Virginia and West Virginia the shipments were 3,150,000 barrels, an increase of 12.8 per cent; the production was 3,145,000 barrels, an increase of 12.9 per cent, and the stocks were 348,500 barrels, an increase of 4.8 per cent. In Tennessee, Alabama and Georgia the shipments were 3,000,000 barrels, an increase of 16.4 per cent; the production was 2,975,000 barrels, an increase of 11.3 per cent, and stocks amounted to 292,500 barrels, a decrease of 23.7 per cent.

The general prices averaged a few cents lower per barrel in 1915 than in 1914, although toward the end of the year they were considerably higher. The statistics show that the general volume of business was about the same, though it was not uniformly distributed throughout the year. During the early part of the year the demand for cement was not great, and in some districts the industry was depressed during the summer by excessive rainfall, but in the last four months or more a decided change for the better has occurred both in demand and prices, so that the outlook for 1916 is brighter than for several seasons.

CONCRETE ROAD TESTS.

The United States Office of Public Roads and Rural Engineering has begun a series of tests at Arlington, Va., to determine the proper thickness of the concrete base for roads of different types when subjected to loads of different magnitudes and when placed on various kinds of sub-base, says a recently issued bulletin of the Department of Agriculture, Washington. In view of the increasing intensity of wheel loads to which roads are now being subjected, the solution of this problem is becoming of great economic importance.

Steps have been taken to mold slabs of varying thicknesses on several kinds of sub-base and test them to destruction, the load being applied through various kinds of paving surface.

Concrete roads are now being built throughout the country with numerous kinds of aggregate and under various construction methods. There is a noticeable difference in the amount of wear suffered by these surfaces, and it is a much-mooted question as to which kind of aggregate will prove most economical under particular conditions of traffic and location of source of supply.

In order to gain information of value in this connection, an instrument has been devised and constructed in the concrete laboratory at Arlington, Va., for the purpose of measuring the amount of wear of concrete roads of different types. Periodical wear measurements will be taken of concrete road surfaces on which the traffic conditions are known.

It has long been known that concrete is not elastic, but attains permanent deformation under working loads. During the course of a series of tests on reinforced-concrete slabs recently made by the Office of Public Roads and Rural Engineering, and now being continued, it was very forcibly brought to the notice of the observers that the concrete continued to deform slowly as long as the load was applied. This fact is significant, as it helps to explain certain stress conditions in concrete roads and bridges when subjected to temperature changes.

In order to study this phenomenon more fully, a series of tests has been begun to determine the "flow" of concrete and reinforced concrete when subjected to direct compression and to bending stresses. Working conditions will be maintained on the specimens as long as they exhibit "flow," and finally the specimens will be broken in comparison with like specimens that have not been previously loaded.

Economy of Large Aggregates

Money Saved and Greater Strength of Product Insured by Use of Large-Sized Aggregates in Machine-Mixed Concrete.

Points of very great importance, emphasizing the possibilities of lowering the cost and increasing the efficiency of machine mixed concrete by using the larger sizes (6-in. and 8-in.) of aggregates, are brought out in a paper recently published by Edward O. Keator, C. E., of Cincinnati, Ohio, formerly Superintendent of Construction of the Gatun Spillway on the Panama Canal.

Chief among the important points in the making of concrete which have received but little attention, says Mr. Keator, is the advantage of using the largest possible sizes of aggregate. By using smaller sizes a great deal of money is thrown away every year. In many instances, principally in paving operations, concrete is now being laid which might just as well be 100 per cent better without costing a cent more, or might be just as good at a much less cost, simply by using larger aggregate.

Size of Aggregate and Strength.

It is generally believed that large aggregate makes stronger concrete than small aggregate, other things equal. Anyone doubting this can enlighten himself by studying the investigations of Wm. B. Fuller and Sanford E. Thompson, published in the "Transactions" of the American Society of Civil Engineers, Vol. 59. First and foremost among the conclusions drawn by these authors is that "stone of the largest size makes the strongest concrete." They also state that the best all-round results with the least cement are obtained with a scientifically grade mixture in which not less than 7 per cent of the cement and sand mixed will pass through a No. 200 sieve, about 38 per cent through a sieve the meshes of which are one-tenth the diameter of the largest aggregate, and the remainder increasingly uniform in size up to the maximum. Usually the best results are obtained, with the least cement, when the largest grains of sand are slightly smaller than the smallest stone.

Scientifically graded mixtures are best, but they are seldom practical. The best results, however, are obtained by using those materials which nearest approximate the scientifically graded materials. This will perhaps explain to the reader the apparent inconsistency of the previous statement.

Influence of Surface Area.

The larger the aggregate, the less surface area to be covered with cement. This means a saving of cement independent of the saving obtained by increased density as related to voids. Surfaces differ from voids in the manner in which they appropriate cement. Voids take the mortar just as it is mixed. Surfaces take the cement and only those grains of sand that are as small as the particles of cement. This is easily proved with the microscope and corroborated by strength tests, and is due to two forces, capillarity and skin friction.

At the age of six months, ordinary 1:2:4 concrete has a compressive strength of about 2,800 lbs. per sq. in. The 1:2 mortar into which the four parts of stone are dumped has a compressive strength of 4,800 lbs. per sq. in. in six months. Thus the stone added to the mortar has robbed the mortar of an amount of cement which leaves it 2,000 lbs. per sq. in. weaker. Moreover, if the concrete is not well mixed, the stone surfaces get their cement only from the mortar in immediate contact with the stone; hence that mortar is weaker than mortar nearer the center of voids, and rupture will occur first at the surface of the stone, a common point of failure. This proves the necessity for thorough mixing, a process lost sight of where "plums," "one-man" stone, cyclopean stone, and the "batch-a-minute" slogan are used.

Surface Area and Size.

Cement may well be compared to paint, since it acts the same way in covering surfaces. A given amount of paint will cover a house on the outside; more will be required to paint the rooms inside the house. Similarly, a large stone in concrete can be covered with a given amount of cement; broken into pieces the stone will require more cement. When it is noted that the strength of mortar in 1:2:4 concrete has dropped from 4,800 lbs. per sq. in. to 2,800 lbs. per sq. in., the importance of conserving the cement in the mortar becomes apparent. The first step is to use the largest aggregate possible; this results in less surface area whether the voids remain the same or are decreased. Since the amount of surface area of a round or square body varies directly as the square of the diameter or of the side, aggregate graded down from 6 in. has but one-third the surface area of an equal amount of aggregate graded down from 2 in. From this it is to be seen that here is an important factor making for strong concrete; and it is reasonable to assume, that with reduction of two-thirds in the surface area where 6 in. maximum aggregate is used in place of 2-in. aggregate, the lost strength of 2,000 lbs. per sq. in. would be reduced proportionately. This would mean then that 1:2:4 concrete using 6-in. maximum aggregate would at six months have a strength of about 4,100 lbs. per sq. in.

Experiments prove the larger the aggregate the denser the concrete. Here follows another saving of cement, because with specified proportions of cement, sand, and stone, it is assumed that the concrete produced can be manipulated. It would be expensive folly to increase the amount of mortar in a concrete that already has sufficient.

Using an aggregate graded down from 6 in. increases the density about 12 per cent with ordinary medium sand and bank-run gravel. In such a mixture there would be 12 per cent surplus mortar, an inexcusable waste. Twelve per cent of surplus mortar contains 24 per cent of all the sand used. If now in a 1:2:4 concrete with ordinary aggregate, sufficient mortar is present, and it is intended to use, in place of this concrete, one with the aggregate graded down from 6 in., a part of the mortar can be eliminated in a manner which will actually increase the strength. Since this mortar contains 24 per cent of the sand put into the concrete, eliminating this amount but with no elimination of cement, leaves 1:1½ mortar instead of a 1:2 mortar; increasing the strength from 4,800 lbs. per sq. in. to 5,600 lbs. per sq. in. This enriched mortar will raise to a higher figure the 4,100 lbs. obtained through decreased surface areas.

Variation in Strength.

Foremost authorities agree that a certain amount of pounding, rubbing, and grinding in the mixer is highly beneficial to the production of the strongest

concrete for any proportions of ingredients. This is most thoroughly done in a given length of time with the largest size aggregate.

It is a serious mistake not to take advantage of the strength gained by using large aggregate to the limit of practicability. Obviously this applies particularly to concrete used to resist abrasion as in concrete road work.

Applying these principles to the construction of concrete pavements, the proper course to follow is very plain. Since good limestone has a compressive strength of 10,000 lbs. per sq. in., a figure away above the strength of any mortar, it is evident that the best wearing surface is one in which the maximum surface of the stone is exposed to the traffic, bound together by the strongest mortar obtainable.

Large Aggregate in Pavements.

There are engineers who argue that one large stone, the diameter of which is the same as the thickness of the pavement, would cause a weak spot in the pavement. The writer is unable to see this, taking the opposite view. He has broken up plenty of concrete with sledge and bull-point and knows full well that the very spot to avoid is the big stone. That is removable only after the concrete has broken away from it.

Now as to the cost of the larger material: Quarrymen say the cost of crushing rock varies inversely as the size. To use the largest aggregate possible would, in most instances, mean a saving in the cost of the stone of from 10 to 50 cents per cubic yard. It might even mean the total elimination of crushers in many gravel banks. Larger material costs less than smaller material, and the amount saved more than offsets the extra cost of handling from the ground into wheelbarrows at the mixer. This applies to crushed stone only and not to gravel, where size makes little difference.

What is the limit of practicability? For an 8-in. pavement, the writer advocates a maximum aggregate of 6-in. crushed stone or 7-in. gravel; and bases this statement on actual experience with large aggregate on similar work. In this matter as in no other pertaining to concrete, is such ignorance and prejudice shown even by the efficiency engineer. The writer has asked many engineers, contractors, architects and foremen what they know about concrete made from an aggregate approximating 6 in. in maximum size. Almost to a man they argue against it, although they admit they have never used, nor have seen used, aggregate of that size. By "used" is meant, run through the mixer and placed as ordinary material. Is it not ignorance and prejudice which prevents a man from seeing and taking advantage of the possibility of a gain of 100 per cent in efficiency? Mr. Keator, in his paper, cites numerous examples of concrete work coming under his observation, in which the relative advantage of the larger over the smaller sized aggregates is indisputably proven.

Machine Mixing Necessary.

Machine mixing, he says, is absolutely necessary to secure the best results. "One-man" stone and cyclopean stone are often put into the concrete after it is deposited and must not be confused with large aggregate that has gone through the mixer. Arguments supporting other methods of securing concrete said to be as good or better than machine-mixed, with the same ingredients, are not supported by the facts. Time and again the writer has examined with great care, good practical samples of hand-mixed concrete, machine-mixed with "one-man" stone added, machine-mixed with cyclopean stone, crushed stone laid, rolled, filled with mortar and rolled again, and, lastly, walls laid up with derrick-size stones, the spaces between being filled with machine-mixed concrete. Every class not wholly machine-mixed shows flaws. These vary from a size into which a knife-blade can barely be inserted to holes large enough to toss a cat through, and are found mostly at the under side of the aggregate units.

The use of small aggregate is our heritage from the days of dry concrete, and of course good concrete is still being made with it; but it is neither the best nor the cheapest. Highway engineers, in particular, would do well to look into the use of larger aggregate.

MEDUSA WATERPROOFING

The Sandusky Portland Cement Company, Sandusky, Ohio, manufacturers of Medusa Waterproofing, has just issued a new catalog illustrating and describing a large number of concrete buildings which were waterproofed with their product. They write as follows:

"Medusa Waterproofing is especially suitable for building blocks, cement plastering, roofing tile, cellar walls, cistern and reservoir linings, conduits, sewer pipe, elevator pits, and in a multitude of other uses in which resistance to percolation of water is required. A trial will convince cement users that Medusa Waterproofing is the only true preventive of dampness in concrete.

"Medusa is specified by the most eminent architects and engineers in the United States and Europe, and is rapidly displacing the oldtime paints and coatings formerly used to prevent the penetration of water into concrete.

"Catalogs containing illustrations, tests and testimonials will be sent on request. We have agents in all the large cities and prompt deliveries are assured."

The United States Government uses Medusa Waterproofing.

The following is a testimonial received from Morris E. Payne, architect and civil engineer, who used Medusa Waterproofing very successfully:

Sandusky Portland Cement Company,
Sandusky, Ohio.

Gentlemen:

I am very glad to testify as to the quality of Medusa Waterproofing. I have had occasion to use quite a lot of your material and have found it to be equal to its manufacturers' guarantee.

While in the employ of the Government I used large quantities in connection with erection of a great many artillery fire-control structures. Most of these buildings were constructed of expanded metal on light steel frames, the expanded metal being plastered with cement, waterproofed with Medusa Waterproofing, on both sides. The buildings are concealed by earthwork to some extent, but at the same time are subjected to severe storms. I do not know of a single instance where any trouble was encountered after using your product.

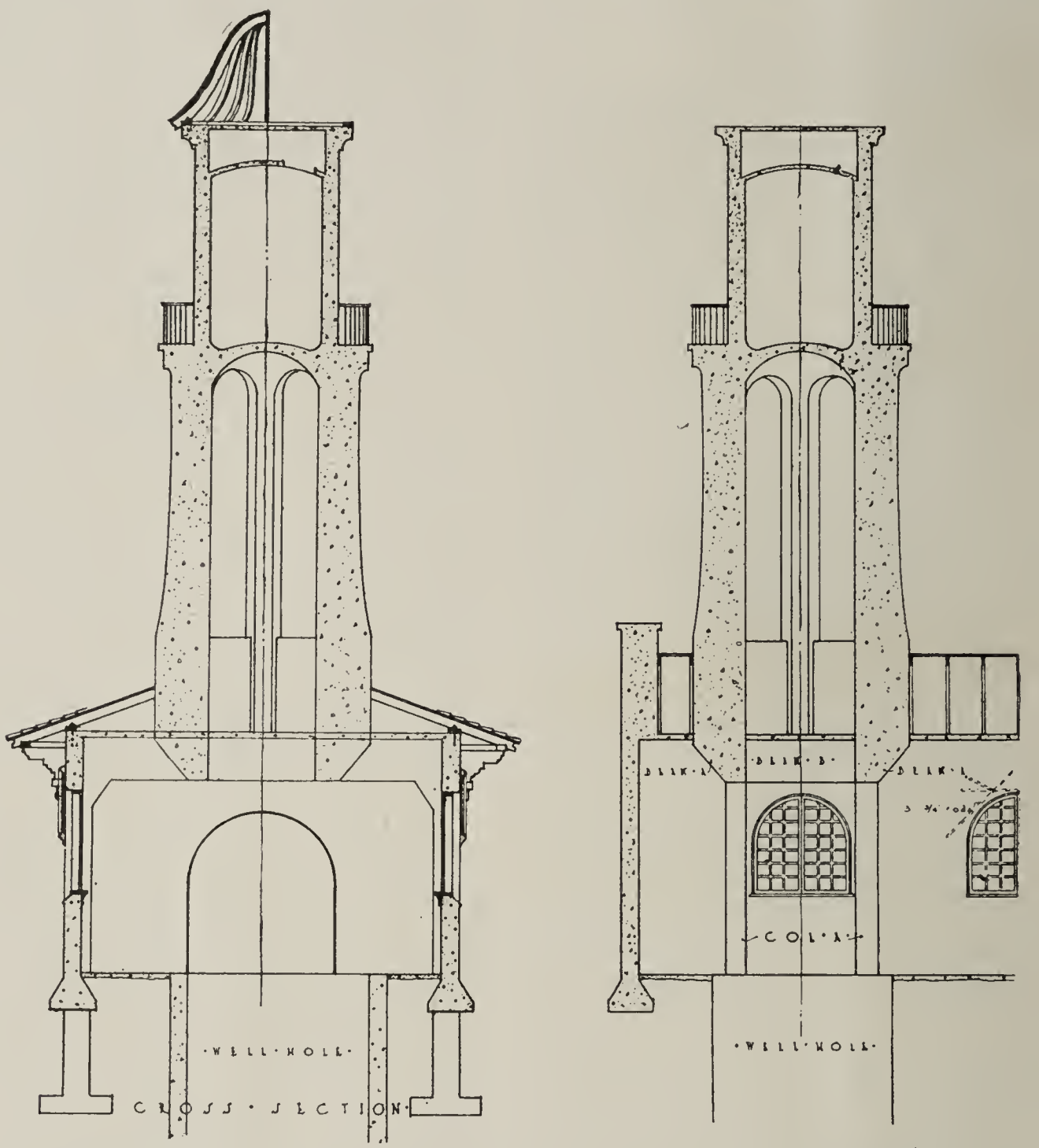
Very truly yours,
MORRIS E. PAYNE,
Architect and Civil Engineer,
New London, Conn., Oct. 6, 1914.

BOOK ON THE MANUFACTURE OF PORTLAND CEMENT.

"Portland Cement," its composition, raw materials, manufacture, testing and analysis is the title of a book by Richard K. Meade, B. S., formerly chemist to the Dexter Portland Cement Co., Editor of "The Chemical Engineer," author of the Chemist's Pocket Manual, etc. Price, $3.50. Sent on receipt of price by Cement and Engineering News, 672 Transportation Building, Chicago.

A REINFORCED CONCRETE RANCH PUMPING PLANT.

A splendid illustration of what may be done in the way of sightly and substantial construction of farm buildings is found in the pumping house on the ranch of T. D. Torrey at Lindsay, Cal. The necessity of economizing often furnishes a reason for crude and cheap building, but there are unfortunately many persons with ample means who are disposed to regard anything as "good enough for the country." There is no sufficient reason, however, why farm buildings should not be made substantial and at the same time attractive when the owner has money available for such structures. Certainly any farm would be the more attractive and more valuable for having upon it buildings that please the eye and will not fall into early decay and ruin.



LATERAL AND LONGITUDINAL CROSS-SECTIONS, T. D. TORREY PUMPHOUSE

Mr. Torrey has upon his ranch at Lindsay a pumping house to the design and construction of which as much time and study was given as is often expended upon much larger and more pretentious buildings. A structure that might have answered all practical purposes for a time could have been erected at less cost, but the money has been well expended and Mr. Torrey will probably never have cause to regret it.

The building, tower and tank are constructed of reinforced concrete with plastered exterior surfaces and clay tile roof. There is a reinforced concrete ceiling slab with wood framed pitched roof over it. The dimensions of the pumping house are 23½x45½ feet. In point of design and construction the tower is unique. There is a well 6 ft. in diameter and about 20 ft. deep with reinforced concrete casing directly under it and in order to give a clear space in the pumping house the tower was carried up on beams supported by columns built into the side walls. The columns rest upon footings 4 ft. square 8 ft. below the ground. Directly under each of the four columns is a steel plate 18 inches square and ⅝-inch thick. The columns are 18 inches square and the reinforcement in each consists of 4 one-inch round steel bars. The principal beams, which have a span of 19 ft. between the columns, are 24 inches deep and 15 inches thick, and the reinforcement consists of eight 1-inch longitudinal steel bars with ⅝-inch spacing bars and ¼-inch stirrups spaced from 4 to 8 inches. The transverse beams are the same size as the principal beams with a span of 6 ft.

The legs of the tower, four in number, rest upon the centers of the beams with a cantilevered corbel at each point of juncture. There are four 1-inch steel bars in each leg. All the heavy vertical bars have ⅛-inch ties 12 inches on centers. The legs of the tower are tied together at the top by 3-inch steel "I" beams.

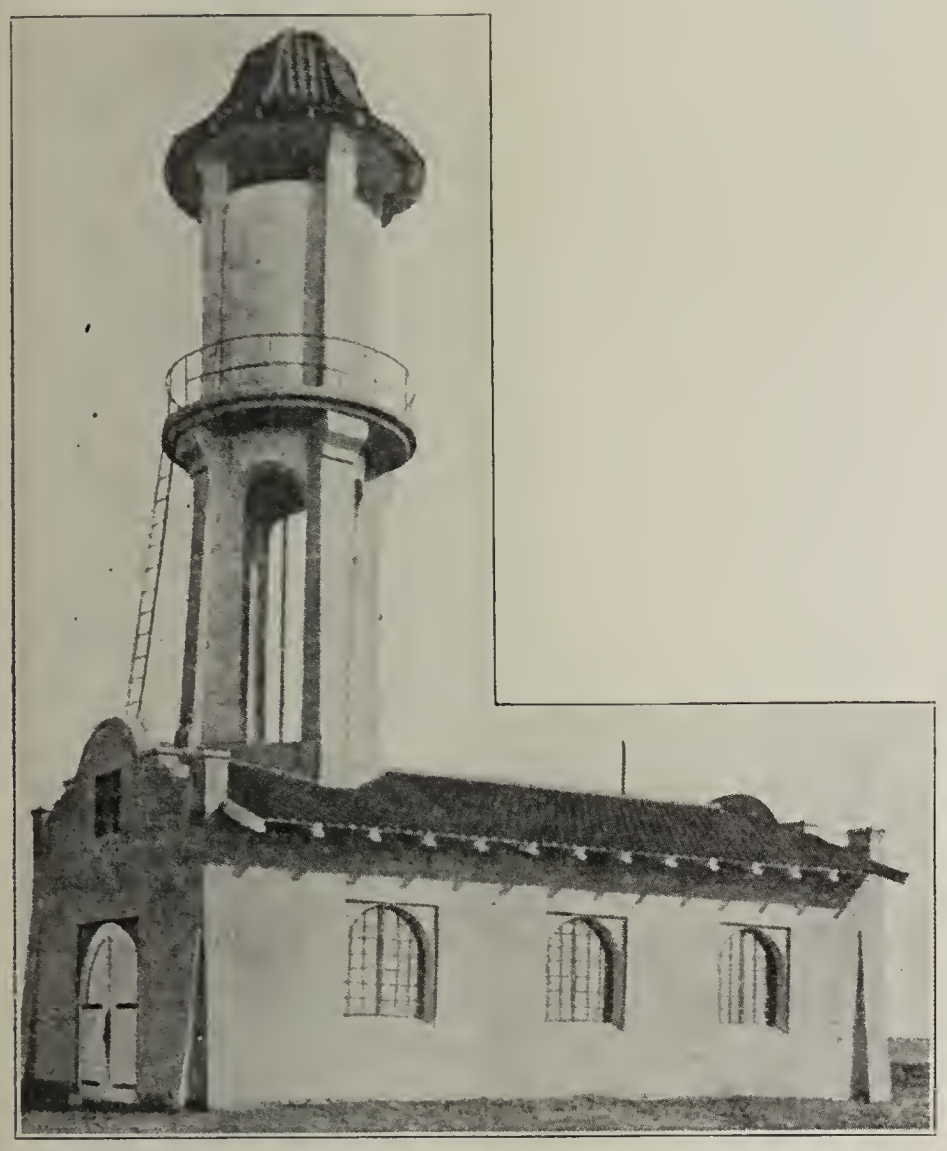
The water tank, which has a capacity of about 3,000 gallons, has a bulging bottom 6 inches thick at the apex. It has an inside diameter of 6 ft. with 3-inch shell and a reinforced concrete cover, making it a huge monolithic bottle. The roof of the tower is carried on four columns run up from the circular platform with the shell of the tank.

The plans for the building and tower were made by

Archt. Norman F. Marsh of Los Angeles. It was built by Guy S. Bliss of Pasadena on a percentage basis. Cost, about $7,000.

CONCRETE SUPPORTS VINEGAR TANKS.

George Seidhoff, a contractor, erected a reinforced concrete base to support large vinegar tanks for the Monarch Vinegar Works, at Kansas City, Mo., recently. It is the first time that this method of support has ever been used, according to A. G. Beamer, manager of the plant, who designed the base and selected reinforced concrete for the material. The huge tanks that this base supports each has a capacity of 500 barrels



Reinforced Concrete Pumphouse, Tank and Tower on T. D. Torrey Estate.
W. F. Marsh, Architect, Los Angeles. G. S. Bliss, Contractor, Pasadena.

of vinegar. A barrel weighs 500 pounds, so that each tank bears a weight of more than 250,000 pounds. There are 12 of these huge tanks on the base, which holds a total of more than 3,000,000 pounds. Two carloads of Portland cement, two carloads of river sand and two carloads of rock were used for the structure. The pillars were sunk to a depth of five feet in the ground and there are about 100 of them three feet by one foot. "Most of the huge tanks of vinegar works are placed under cover and directly upon the wooden floors of the building. In this condition they last only a short while and have to soon be rebuilt," says Mr. Beamer. "Now that such a strong material as reinforced concrete is available, the tank will last much longer and do no damage to the building whatever."

FALSE ECONOMY OF WEAK DETONATORS.

For years the Du Pont Company and the Government Bureau of Mines have urged users of high explosives to detonate them with No. 6 or stronger detonators (preferably electric detonators), for the following reasons:

1. Strong detonators increase the efficiency of the explosive in much greater proportion than their higher cost.

2. Strong detonators greatly reduce fumes and smoke because of more complete detonation of the explosive.

3. Strong detonators reduce accidents by reducing dangerous fumes, obviating unexploded charges (all or part) in bore holes, and making possible a reduction in the amount of explosive charge and the use of less sensitive, hence less dangerous, explosives in the work.

4. Strong detonators should be used with all Permissible Explosives, for they will be declassed and unsafe if detonated with a cap weaker than a No. 6 (see Bureau of Mines specifications).

Much of the progress made in the line of greater efficiency and safety by the almost general use of No. 6 detonators is now threatened on account of slightly increased cost of detonators. Some users of explosives have gone back to weaker ones with the mistaken idea that they are saving money.

They are not!

From all such who are Du Pont customers we know we will receive complaints that our dynamites are insensitive, produce bad fumes, and fail to do their work properly. There will also probably be reports of accidents due to bad fumes, misfires and gas explosions.

No adjustment can be made of such complaints when users are plainly violating the recognized rules of economy and safety by using weak detonators.—Dupont Magazine.

CONCRETE PAVING NOTES.

Athens, Ga., last year built two-course concrete by city forces at a cost of $1.14 per square yard, the total thickness being 7 inches. The base or bottom course was constructed of stone from old macadam and was mixed 1:3:5. The top was mixed 1:2.

In New Britain, Conn., concrete roads were built in one course, 8 inches thick in the center and 6 inches on the sides, and were reinforced throughout.

In Robinson, Ill., concrete pavement was laid with a reinforcement of ½-inch square twisted bars, placed 1 foot each way. The price for this pavement, 8 inches thick at the center and 6 inches at the edges, not including any grading, curb or other work, was $1.35.

Davenport, Ia., laid 17,617 square yards of one-course concrete 6 inches thick last year, all of which was placed in alleys.

In Fairmont, Minn., concrete pavement is used in alleys only. Six-inch one-course pavement is laid, the mixture being 1:2:3, using local gravel and New Ulm quartzite sand.

Concrete pavement laid in Lake Geneva, Wis., was reinforced and expansion joints placed every 45 feet; was 8½ inches thick at the center and 6 inches at the gutter and had a crown of 3½ inches.

DIXIE CEMENT COMPANY RE-ELECTS OFFICERS.

At the annual meeting of the stockholders of the Dixie Portland Cement Co., of Chattanooga, Tenn., the old board of directors was re-elected with the exception of C. E. James, the number of members having been reduced from twelve to eleven. Following the stockholders' meeting the directors met and re-elected all of last year's officers. The re-elected officers and directors are: Richard Hardy, Chattanooga, president; G. W. Millen, Ann Arbor, Mich., first vice-president; William Barnes, Chattanooga, treasurer; George Kilian, Chattanooga, secretary; F. H. Yost, Nashville; T. G. Garrett, Nashville; Dr. J. P. Gillen, South Pittsburgh; Capt. H. S. Chamberlain, Chattanooga; Leigh Hunt, Kansas City, and A. I. McLeod, Detroit, directors. Mr. James sold his holdings in the company several months ago.

CEMENT AND ENGINEERING NEWS

(PUBLISHED MONTHLY)

WILLIAM SEAFERT, Editor and Publisher

Office—672 Transportation Building, Chicago

Telephone, Harrison 5397 Cable Address, "Seaferts" Chicago

Entered at the Post Office at Chicago, as second-class matter, July 21, 1896 under Act of March 3, 1879

SUBSCRIPTION RATES:

United States, Canada, Philippine Islands and Mexico, two years for $1.00; all other countries, $1.00 per year.

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CHICAGO, MARCH, 1916

WATER IN CONCRETE MIXTURES.

Although the tendency is now to use wetter mixtures for concrete than prevailed in general practice some years ago, there is still controversy among self-styled authorities, engineers, and contractors as to the proper consistency for concrete mixtures. In most cases, the amount of water used has represented the arbitrary opinion of the engineer or person in responsible charge of the construction.

In reinforced concrete work, there is no question but that wet mixtures facilitate placing the concrete in intimate contact with the reinforcement, but in reinforced work there is a possibility that too much water will be used, so that after the process of crystallization has been completed in the cement, an examination of the concrete would show pockets of voids along the reinforcement.

The average contractor, simply for his own convenience, will frequently use more water in his concrete than necessary, because a wet mixture facilitates spouting, and consequently saves time and money in placing expense.

As in all things, there must be a happy medium, so in concrete it is evident that the advocates of dry mixtures and the advocates of wet ones cannot both be correct. Tests have been recorded of experiments made in the Engineering Testing Laboratory of the Sheffield Scientific School, Yale University, involving experiments based on 1:2:4 mixtures, used in varying percentages of water. Conclusions based on these tests showed that concrete mixed with 27½ per cent of water developed at the end of thirty days a maximum resistance, both to tension and to compression, in comparison with mixtures made with other percentages of water.

Another interesting point brought out by the tests referred to was that to attain corresponding strength in mixtures using 30 per cent and more of water, an increase from 5 per cent upward in materials was required to equal the results shown by the mixtures containing 27½ per cent water.

This means that for concrete to meet certain test requirements, the contractor may give himself a margin of 5 per cent or more for profit by adhering to the 27½ per cent contents of water.

CONCRETE IN SEA-WATER.

Present practice on the Southern Pacific railroad in depositing concrete under sea-water, says William Hood, is about as follows: After selecting the best available cement, it is mixed rather dry and the concrete is deposited as much as possible where there is no current or movement of the water. A long cylindrical bucket with a butterfly-leaf bottom is used to deposit the concrete. The bucket is lowered into position closed and is hoisted away from the concrete so that the latter does not fall or drop through the water.

Cement that contains a large proportion of aluminum does not behave well under sea-water, but this tendency seems to be largely counteracted when a considerable amount of iron oxide is present. As a general rule, if the proportion of iron oxide is subtracted from the proportion of aluminum, the difference should not materially exceed 4 per cent. For instance, if the proportion of aluminum is 7.11 per cent and the proportion of iron oxide, 3.34 per cent and the cement is otherwise satisfactory, it may be used under sea-water. Or if the proportion of aluminum is 6.71 per cent and that of iron oxide, 2.09 per cent, and the cement is otherwise of particularly good quality, it can still be used under sea-water.

It is also advisable to keep a careful watch upon the cement during the first few days after being mixed, and if it develops extreme slowness of setting or other objectionable qualities, to discontinue the use of that particular brand.

GET REDUCED RATE ON SAND AND GRAVEL.

Based on an order issued by the public utilities commission of Ohio, the Pennsylvania lines, the Baltimore & Ohio Railroad Co. and the Erie Railroad Co. are required to establish on or before February 15, 1916, lower rates on sand and gravel from Akron to various points.

This order is the result of a complaint filed about a year ago by the Akron Gravel & Sand Co., of which Mr. W. E. Wright is secretary, alleging unjust and unreasonable rates on sand and gravel as well as discrimination in the rates on sand and gravel in favor of other commodities, such as crushed stone and slag.

Some of the important reductions are to Youngstown, Ohio, from 53 cents per ton to 48 cents per ton; to Canal Dover, O., from 58 cents to 48 cents per ton; to Ashland, O., from 53 cents to 48 cents per ton; to Mineral City, O., from 53 cents to 42 cents per ton; to Medina, from 47 cents to 37 cents per ton; to Alliance, O., from 53 cents to 42 cents per ton, and to Wadsworth, O., from 42 cents to 37 cents per ton.

The fight for lower rates on sand and gravel from the city has been conducted for the Akron Gravel & Sand Co. by Mr. E. Brooker, formerly chief of traffic bureau of the Erie railroad, now located with the sand company, and Attorneys C. C. Benner and F. J. Rockwell, Jr.

CONCRETE ROAD CONSTRUCTION.

A so-called failure of a concrete road occurred in one of the middle western states during the past year. On investigation, however, it was found that in many places the concrete was not more than three inches thick, where the plans and specifications called for seven inches. Aside from any consideration of the culpability of the contractors in a case of this kind, one is led to wonder where the engineer was at the time this concrete was being put in. It is a forcible incident to drive home the recent remarks made by Mr. Logan Waller Page, in which he sought to impress upon the public the necessity of having experienced road builders rather than politicians in positions of authority in the highway department.

CONCRETE FOR TREE SURGERY.

Many a fine old tree whose heart is being eaten out by decay can be saved by the intelligent use of a little concrete. As nearly every one knows, most trees grow by the yearly addition of a new ring of the wood immediately under the bark. This new ring, known as "sapwood," may be likened to the arteries in the bodies of men and animals; without it the sap—which is the blood of the tree—cannot make its way from the roots to the branches. Cavities, occurring from any cause, gradually increase in size until, through lack of nourishment the tree starves, weakens, and eventually dies.

Wonderful advance has been made in tree surgery, sometimes spoken of as tree dentistry; but no lesson that it has taught is more important than this; that bark and sapwood will eventually grow over concrete-

Pepper Tree on Euclid Avenue, Ontario, Cal., Treated with Cement to Check Further Decay.

filled cavities. Naturally this has led ill-advised persons to undertake the treatment of their own trees without understanding that success could be attained only by observing certain necessary precautions.

In the first place, the cavity should be thoroughly cleaned. If you have ever had a tooth filled, you will recall the dentist's painstaking and pain-giving diligence in this respect. As with a tooth, so with a tree. Decaying wood or fungus growth left in the tree under the concrete will cause decay to continue. After the cavity has been thoroughly cleaned and scraped, it should be treated with a germicide such as creosote crude petroleum, or a copper sulphate solution made by dissolving ¼ pound of sulphate of copper (blue vitriol, commonly called blue stone), in 10 gallons of water.

Following this treatment, a thick coating of hot tar should be applied to act as a spring or expansion joint to prevent the wood from cracking the concrete.

If the cavity is large, concrete should be reinforced. This may be accomplished by driving a number of 20-penny nails in the cavity, or by using ¼-inch iron rods extending from side to side of the opening. The kind of reinforcement will depend upon the shape and size of the cavity.

Before beginning to fill the cavity, the surrounding bark should be cut back ½ inch from the face of the opening. Concrete should be mixed in proportions of 1 sack of Portland cement; 2 cubic feet of clean, coarse, screened sand graded in size from fine particles up to ¼ inch; and 3 cubic feet of gravel or broken stone varying in size from ¼ inch up to ¾ inch. Enough water should be used to make the concrete of jelly-like consistency, and care should be taken to work the concrete thoroughly into every part of the cavity.

If the cavity is so open that a form is required to hold the concrete while hardening, heavy burlap or tin may be tacked to the tree and across the opening. If tin is used, the surface next to the concrete should be greased with a mixture of equal parts of raw linseed oil and kerosene. When the concrete has partially hardened—that is, a few hours after placing—the form should be removed so that the surface may be finished to conform to the natural shape of the tree, in order that no deformation may appear after the bark shall have grown over the concrete filling. Damp burlap, or other moisture retaining material, should then be lightly fastened over the concrete fillings and kept moist for a week while the concrete is hardening.

GROUTING OUTFIT.

The Jaeger Machine Company, 212 W. Rich Street, Columbus, Ohio, has just published a little folder showing how the grouting of street pavements can be done to advantage with the Jaeger outfit.

This outfit consists of a Jaeger "Big-an-Litle" mixer, complete with loader, and two Turner grout carts. This cart is so constructed that it has a set of blades inside, these blades revolving as the cart moves, keeping the grout agitated and preventing the sand from settling. When the proper place is reached the cart is tipped and discharged, partly spreading the grout ready for the broomers to finish.

LINK-BELT LOCOMOTIVE CRANES.

Book No. 158 of the Link-Belt Company of Chicago describes and profusely illustrates the Link-Belt locomotive crane, which combines, in one machine, a portable hoisting engine, swinging derrick, grab bucket unloader and switch engine. Forty pages of illustrations show the ever-increasing application of the locomotive crane and its adaptability to a wide range of service and conditions.

SOME FACTS ABOUT LIMESTONE.

A ton of absolutely pure limestone would burn to a little over half its weight of lime, or about 1,120 pounds, which, counting 80 pounds to a bushel, would give 14 bushels of lime to a ton. The weight of the burned product, however, generally averages more than this, owing to impurities in the limestone and also because in ordinary kilns the combustion is not complete enough to drive off all the carbon dioxide.

A cubic foot of limestone averages in weight from 145 to 175 pounds, which would make a ton of limestone contain from 11 to 14 cubic feet.

PENNSYLVANIA BUILDS CONCRETE ROAD AS OBJECT LESSON

To serve as a model, both in quality of finished work and in construction method, the Pennsylvania State Highway Department is building with its own forces a 16-foot concrete road between Bethlehem and Easton, a distance of 8½ miles. In this work the cement companies of the Lehigh district are co-operating by supplying all cement free of charge and by sending engineering representatives to observe the methods used and offer suggestions based on a wide experience with concrete road construction in other states. Among the construction features of this object-lesson road are the thorough compacting and under-draining of the subgrade, and strict adherence to established grades. Every batch of concrete is mixed 90 sec., and sufficient water is used to make the concrete plastic, so that it does not quite level down in the discharge bucket. Since the dolomitic limestone used was proved by tests to have practically the same resistance to abrasion as the mortar, a 1:2:3 mix is used, thus insuring an easily-worked, homogeneous concrete.

On the theory that the cracks in concrete roads which are not reinforced are of surface origin, the slab length has been increased to 39 feet 6 inches, and mesh reinforcement, placed at 2½ inches from the top, is used to eliminate longitudinal cracks caused by settlement of the shoulders. An extra heavy strike board, followed by a lighter one, insures the thorough compacting of concrete and eliminates the formation of rolls in the surface. The broomed finish has been discarded in favor of the wood-float finish. At expansion joints a 3/16 inch radius edger is used, and at the sides a ¾-inch radius edger. This is expected to eliminate chipping. At present eight test cubes each week are taken from the regular batch of each mixer, and these cubes are tested after 7 days, 14 days, 28 days and 6 months.

Modern Construction Methods

Full use is being made of the resources of the territory in which the road lies to secure the cheapest acceptable road materials. Up-to-date road machinery in the most economical units is employed. The trolley line which parallels the road handles the distribution of stone, sand and cement. A small quarry available midway between Bethlehem and Easton has been opened. Two portable crushers are used, and the bins discharged into the cars on a spur from the trolley line. This quarry is supplementing the available supply of commercial stone, and cutting costs. The tailings and fine stone from these crushers are used in drainage ditches and on the shoulders of the finished road. The rock excavated in grading is crushed in a portable gasoline-driven "coffee-mill" crusher, and is used to cover the tile drains, which are laid in advance of concreting. The work was begun in the middle and is being carried in both directions toward Bethlehem and Easton by two completely equipped crews.

Building a Modern Concrete Road.

Order of Construction

After the rough grading is done the sub-grade is finished and rolled while the drains are being put in. The concrete crew, the finishing crew and the curing work follow in order, after which the earth used to cover the concrete is made use of by the "trimming-up" gang. Special attention is paid to the proper distribution of concrete materials, and rehandling has been practically eliminated. The sand and stone cars are spotted by the foreman at measured distances from the end of the last concrete. The men are distributed with care to insure uniform progress of each operation, from the rough grading to finishing the shoulders.

Road Foundation

The present roadbed is of clay, mostly without heavy cuts or fills. All fills are made in 1-foot layers and thoroughly rolled with a 10-ton roller, one of which is provided at each end of construction. Adequate longitudinal and transverse porous tile under-

drains are being installed. Corrugated iron pipes are used to pass water under the roadbed where necessary, and concrete box culverts are built in advance of concreting to care for small streams and heavy watersheds. The side drains are of 4-inch porous tile, and are laid on ½x4-inch boards to maintain an even grade. They are set 18 to 24 inches below subgrade and laid with covering of one-ply tar paper, wrapped around each joint, with the lap on the bottom. This paper contains little tar and will allow easy ingress for the water at joints. This method provides a joint which is thought to be considerably stronger and which is expected to last longer than the bagging joint generally used. The ditches are backfilled with tailings from the crusher plant and with stone from the grade cuts.

Grade stakes are set every 25 feet and the subgrade is finished very accurately. It is rolled until thoroughly compacted. Although an effort has been made to spend no more money on this work than the saving of concrete justifies, a majority of the slabs have been laid with less than 4 per cent variation from the theoretical volume and several have run the exact computed yardage.

Concrete Work Arranged Economically

Stone is loaded directly into the cars of the Easton Transit Company at Bethlehem and at the small quarry. Sand and cement, the former coming from a sand dredge at Succasunna, N. J., is transferred from the railway to trolley cars at Taylor Road, outside of Easton. The sand grades from fairly fine to pea gravel, and, being dredged, is very clean. Cement is stored in portable canvas sheds holding 90 sacks each, placed at measured distances along the road, and carried ahead as they are emptied. Accurate measuring of the sand and stone is accomplished by wood-box barrows of special design and 3 cubic feet capacity, shown in the photographs. They are struck off with a shovel. One No. 16 Koehring mixer of 3-bag batch capacity is used on each end of the concrete work. These machines have a boom delivery. The side forms are made of 6-inch channels in 12-foot lengths, held in place by steel stakes. The finished concrete is 6 inches thick at the sides and 8 inches at the center, and is being laid on a level subgrade. The subgrade is sprinkled with a hose before placing concrete.

The reinforcing comes in sheets 5 feet 2 inches wide, and in lengths of 6 and 10 feet. It is laid with lengthways joints staggered, and with a lap of 4 inches crosswise of and 12 inches parallel to the roadway. Expansion joints are made by tying two 9-inch by 16-foot strips of ⅛-inch Elastite to a 9 by 16-foot plate. This assembled form is securely placed with the Elastite next the slab being finished. "Elastite" expansion joint, known as the Sandwich joint, is manufactured by the Philip Carey Company, Cincinnati, Ohio. Concrete is poured on both sides of joint, that on the back side is struck off, the strings are cut and the plate pulled out by handles, leaving the joint in place. After the concrete has set for 24 hours, the joint material is trimmed off ½ inch above the concrete surface.

The concrete crew is organized with three finishers, two men who handle both strike-boards, three men placing concrete and reinforcing, one mixer engineer, one fireman, one charging man, two men on forms, three men on cement, and from eight to twelve men on stone and sand. Although every batch is mixed 90 sec., this crew can place more than eight slabs in a 10-hour day, making more than 100 cubic yards; seven slabs can be run without crowding.

Let Concrete Set a Day Before Covering

Under a very hot sun the fresh concrete is protected by canvas. On cool days it is simply wet occasionally with a hose. After 24 hours the forms are removed and the surface is covered with a few inches of dirt. This is wet night and morning for 10 days, and is removed after 14 days and placed on the side slopes or where needed. All traffic is kept off the subgrade, and as all materials are delivered by the trolley line, which parallels the road, there is no occasion for even construction wagons to use the subgrade after it has been finished. This permits keeping the rollers about a half a mile in advance of the concrete crews.

Rapid and Economical Progress Expected

Although the work has been in progress only three months, practically 4 miles of the 8½-mile stretch have been graded, 3 miles subgraded, and 2 miles concreted. This has been done although labor has been hard to get, and although stone deliveries were so slow at first as to keep one mixer idle a large part of the time. Steel mills in the vicinity are very busy, and men shipped from outside to recruit the camp of 150 laborers maintained are hard to hold.

The work is being done under the direction of William D. Uhler, chief engineer of the Pennsylvania State Highway Department, and George H. Biles, second deputy highway commissioner. J. T. Gephart, Jr., is acting engineer of the district in which the road lies, and J. E. Sampson has entire charge of the work as superintendent for the State Highway Department.

JAEGER HAS NEW DEVICE.

Inclined Trackway for Placing Concrete Is Run by Mixer Hoist.

You can always count on The Jaeger Concrete Mixer Company for something new at the Cement Show. Being ahead of the procession is one of their specialties. This year it is their device for placing concrete in foundations, bridge piers, culverts, etc.

Very often it is difficult for a mixer to get near the actual point of pouring. Rough sloping ground, or some such difficulty interposes, or else it is undesirable to move the mixer every little while. Jaeger's new device overcomes this. It consists of an inclined trackway resting on metal supports, up which runs a car or barrow from the mixer to a chute leading from a hopper at the top of the incline, into which the car dumps automatically. The best part of the whole device is that it is operated by an extra hoist on the mixer itself; no additional hoisting engine is necessary. The chute can be swung around in any direction and the mixer can cover a lot of ground from a single set-up.

The whole Jaeger exhibit, along the north wall of the Coliseum, attracted a great deal of attention at the Chicago Cement Show. The Big-an-Litle mixers, with their gold drums and red frameworks, showed up well, and the white-capped demonstrators and salesmen eagerly answered all questions. Write the Jaeger Machine Co., 212 W. Rich street, Columbus, O., for their new catalog illustrating and describing the new inclined trackway for placing concrete.

CONCRETE SEPTIC TANKS.

The Universal Portland Cement Company, Chicago, has just issued an eight-page bulletin entitled "Concrete Septic Tanks for Farmhouses and Dwellings in Small Towns." The increasing interest in sanitation has created a considerable demand for information along this line, making a bulletin of this kind very timely. Illustrations are given showing the various features of such structures, and the Universal Portland Cement Company also offers to furnish larger blueprints of the plans, together with notes detailing construction requirements, for all who are particularly interested.

Among The Cement Mills

HOUSTON'S NEW CEMENT PLANT.

Enterprises, some of them of national importance, are making arrangements to take advantage of the industrial facilities provided by the Houston Ship Channel, and are thus adding to the development of this splendid waterway. There has been marked activity during recent months, particularly since the inauguration of regular steamship service between New York city and the port of Houston.

View of Three-car Shipment, Kiln Machinery, for New Cement Plant in Houston; Weighing 146,000 Pounds.

Probably the most important project in its effect upon channel utilization is the plant of the Texas Portland Cement Co., now well under construction and to be completed early in the spring. This company not only appreciated the advantages of having a plant at the head of navigation where it could secure cheap rates and where it could economically handle its Southern business, but it proposes to take advantage of the opportunity to land the export trade of South and Central America, for which it will make a bid, and the channel will be used to bring the raw material inbound, and for its export and Atlantic coastwise trade.

The company acquired 15 acres of land fronting 400 feet on the ship channel, running back 500 feet, and the plant will have a capacity of from 300,000 to 400,000 barrels of cement annually. Shell obtained in Galveston Bay will supply the lime ingredients, and clay will be secured from a deposit nearby. The shell will be brought up the channel by barge and delivered at the wharf, the capacity calling for the daily use of 250 yards. The material will be mixed and ground wet, Kominuters and tube mills being used for the raw material, as well as the clinker grinding, and the raw mix will be fed into a kiln 220 feet long and 9 feet in diameter, having a concrete stack 175 feet tall. Power for operating the mill will be furnished by Diesel oil engines. Motors, together with switchboard and generator for the powerhouse, are now being shipped. Ball mills and tube mills are being furnished by F. L. Smidth & Company, 50 Church street, New York. There will be very little transmission machinery, as all machines will be direct driven either through gearing or direct belting from motors. No crushers or pulverizers will be used other than the tubemills, and no dryers will be used.

The cement will be stored in cylindrical concrete bins 32 feet in diameter and 60 feet high, there being four in number. All of the mill buildings will be of concrete and steel throughout, and will have both rail and water transportation facilities. A wharf is also under construction, from which the cement can be loaded into vessels for export. The completed plan will represent an expenditure of $350,000.

The Texas Portland Cement Company also operate a plant in Dallas.

TRINITY CEMENT COMPANY HAS NEW OFFICERS.

W. H. L. McCourtie of Minneapolis, Minn., was elected president of the Trinity Portland Cement Company at the annual meeting of the stockholders and of the directors last week in the offices of the company in the Commonwealth Building, Dallas, Tex. C. E. Ulrickson of Jackson, Mich., is the new general manager. Both succeed H. R. Breck of Dallas, who has been president and general manager during the last four years.

The directors were unanimous in their expressions of regret at Mr. Breck's resignation.

Mr. McCourtie is one of the two founders of the company. He will continue his residence in Minneapolis, though he will be in Dallas several days. Mr. Ulrickson will make his home in Dallas.

The other officers of the company are: C. H. Wagner of Minneapolis, vice-president; R. L. Lumbard of Dallas, secretary; and these directors: Mr. McCourtie, Mr. Ulrickson, Mr. Breck, F. G. Ray, Vinton, Iowa; C. B. Ayers, Chicago; M. T. Gunderson, Kenyon, Minn.; C. H. McNider, Mason City, Iowa, and M. J. Scanlon, Minneapolis, Minn.

Kiln Gear Wheels and Supports for the New Cement Mill at Houston; Weight 30,000 Pounds.

CEMENT COMPANY OFFICERS.

The annual meeting and election of officers of the Wolverine Portland Cement Company, Coldwater, Mich., took place recently. The old board of directors was re-elected. L. M. Wing was elected president by the board of directors, and C. C. Jones of Quincy, vice-president.

Among The Cement Mills

CEMENT PLANT MAY MANUFACTURE POTASH.

Method of Handling This Valuable Product Explained.

Vice-President and General Manager J. J. Porter, of the Security Cement and Lime Company, with plants at Security, Md., and at Berkeley Station, who a short time ago went to California to investigate the plant of a portland cement company there engaged in utilizing the potash contents of the rock used in making cement, on Monday, reported his findings to the officers of the company. The potash comes largely from the dust of the plants which can be gathered and conserved, and in addition to rendering the surrounding neighborhood free from dust nuisance the company is also enabled to secure a by-product of considerable value and especially now as potash is selling for about $500 per ton. Potash always was very high, although is now many times its former cost. It is a most important constituent of farm fertilizers and in times of war, is largely in demand in munition manufacture.

It is stated the rock used at the Security plant is rich in potash, and it is further estimated that probably as high as $2,000 worth of this salt is lost on some days. To build a plant to care for this by-product is is stated would cost $50,000, or more. The whole plan will be laid before the directors on Wednesday for action.

The method of securing potash by cement plants is explained by a government official. This official says: The possibilities of securing potash from the new sources is made all the more interesting by the fact that the substance has been gotten in cement plants as a result of effort to avoid harming orchards and crops in the vicinity and by the additional fact that the apparatus by which the recovery is effected is the invention of F. G. Cottrell, now engaged in chemical investigations for the bureau of mines.

Thousands of tons of dust are driven into the air from the stacks of cement plants all over the country, and, settling on vegetation, causes numerous complaints and lawsuits. To avoid trouble and payment of damages large cement plants in the west bought up nearly a million dollars' worth of adjacent land and found that its discharged dust still floated beyond its property limits and continued to cause damages. It then installed apparatus which captures the dust particles by electrical attractions and now piles up in bins each day approximately 100 tons of material that formerly was spread over the countryside.

In catching the ordinary clay and lime dust that goes into the manufacture of cement the electrical current also catches the valuable potash that has been unlocked from the raw materials by heat. The potash forms such a substantial part of the dust that the whole mixture, where the electrical recovery process has been installed, sells readily as it is caught for fertilizer uses for almost as good a price as the finished cement. When the dust is reheated in a special kiln and the electrical fingers again snatch all that they can from the passing gases, a high concentrate of the potash is secured which is still more valuable. How soon the chief producers of cement can be depended on to save the potash they are now sending up their chimneys is a question that government metallurgists and chemists cannot answer; but an idea of what such a saving would mean to the United States in national production of potash, now produced here in only negligible quantities is given by the figures of the geological survey, which place the American output of portland cement in the United States in 1915 at more than 86,000,000 barrels.

SHOULD THE WEIGHT OF A SACK OF CEMENT BE INCREASED?

It is human to favor what appears to be the more simple and the more logical of permissible alternatives. For that reason the proposal to change the weight of a sack of cement from 94 to 100 pounds generally meets with instant approval. Not only is 100 a good round figure, but 100 pounds of cement measures more nearly a cubic foot. Little wonder then that at first thought it seems desirable to change the weight to the higher figure. Little argument is needed—the round figures in both weight and in volume discourage careful analysis. As a result are we not expecting more than we are warranted from the prospective change—and it is prospective if rumors from the joint conference committee on cement specifications and tests are to be believed? Is there not, too, a broader aspect to be considered, to which this ready acquiescence to the increased proposal blinds us?

The chief argument in favor of the heavier package, aside from the evident fact that there is no good reason for retaining an odd weight like 94 pounds, is that proportions are based on the sack, and that the sack is assumed to hold a cubic foot of cement. If, then, a package holding 6 pounds more is used, the result will be to insure a richer mix.

Two different aspects of the subject present themselves, depending upon who sets the proportions and determines the method of securing them in the field. If the proportioning is in the hands of a competent engineer and the structure is of sufficient importance, a stereotyped mixture, 1:2:4 or 1:3:6, will not be used, but the proportions for maximum density will be carefully found by experiment. Whether a sack of cement then contains 0.94 cu. ft. or 1 cu. ft. is a matter of indifference; the measuring boxes for sand and large aggregate will be built according to the sketches of the engineer, and the decimal does not worry him.

When, on the other hand, the stereotyped proportions are used, the expected advantages are based on the assumptions that boxes, wheelbarrows and hoppers are ready-built to even-cubit-feet capacity. This, of course, is not so, and where accurate proportioning is desired the boxes must be built for the particular job. On a great amount of work, however, measuring boxes are not used. A sack of cement is dumped into a wheelbarrow and its volume noted. Each batch then is to contain twice as much sand and four times as much stone, for a one-bag 1:2:4 mix. Or a sack full of sand is thrown into a wheelbarrow. Its displacement is then taken as a unit for the multiple quantities of fine and coarse aggregate. In both methods it is evident that it makes no difference whether the volume of the sack of cement is 0.94 cu. ft. or 1 cu. ft. It appears to this journal, therefore, that the advantages expected from the increase in weight have been overdrawn.

When all is said, however, it is not easy to escape the attractiveness of the 100-pound sack, and sentiment, even if without good ground, is likely to grow in its favor unless some good reason against the change is adduced. Evidently the discussion above only fails to find any special advantage in the heavier package and does not produce any testimony against the proposed innovotion. The objections to the change must come from the manufacturers, and they, so far as this journal knows, have not yet stated their side of the case. The direct money outlay in the transition to the larger sack (only 10 per cent of the present sacks will hold 100 pounds of cement if placed by present types of packing machinery) may be dismissed from consideration, for the change could be brought about

only as present sacks wear out. A period of four years would probably see the retirement of all but a small percentage of the old containers. The cost to the manufacturer would lie in the extra handling on account of having two sizes of package, a matter that affects not a few plant operations, such as the receipt and storage of sacks and the arrangement of packing and shipping facilities. This extra expense would eventually have to be borne by the consumer. Whether it is justified by the results depends upon the estimate of the expense involved, and, as to this, the manufacturers must speak. As pointed out in this comment the gain to be expected is comparatively small.

One other phase of the subject is worth more than a passing thought. "The sack nuisance" is a common characterization by contractors of the return system necessary where 40 cents' worth of sack is necessary to ship a dollar's worth of cement. The handling of returns, their collection, inspection, bundling and shipment, together with the inevitable losses, are a constant annoyance to the contractor, while at the receiving end the returns are no less troublesome. It was to escape this nuisance that bulk shipments of cement were first suggested and have since been advocated. Before changing the package, therefore, it might be wise to consider carefully the possibility of eliminating the sack nuisance. This might be done by packing in paper. Fifty-pound paper bags are now feasible, and studies of the possibilities of an 80-pound paper sack are under way. The higher breakage losses, and the cost of the unreturnable paper bags and of handling a greater number of packages for a shipment of given size, are offsetting disadvantages. Their magnitude can be determined only after detailed study.

Enough has been said to indicate that the question is not to be dismissed by a wave of the hand. Surely there should not be a change in weight of package without first considering the advantages as against the cost, and without studying the possibility of eliminating the present costly containers.—*Engineering Record.*

ITALIAN CEMENT INDUSTRY.

The Manufacture of Colored Cement Tiling for Floors.

In Palermo there are two factories producing natural cement, writes United States Consul Samuel H. Shank, Palermo.

Most of the cement now manufactured is used in Sicily, little being exported to the continent. Reinforced-concrete construction has been used very little in this district, as there is a building stone available here that is cheap and durable. This stone is very soft when first taken from the quarry and may be cut with an ordinary ax, but after some months' exposure to the air it hardens and is very durable building material.

The largest users of cement are the factories that make tiling for the floors of houses, and contractors building sidewalks. The cement-tile business has been developed to a great extent and artistic designs are produced in various colors.

Around the smooth steel plate is locked a frame in which is inserted the design. Liquid cement is then poured into this container to the depth of about one-fourth of an inch, the different colors being used to give the desired pattern. The steel design is then lifted out of the frame, which is filled with a mixture of sand and cement and put under a power press. The frame is then removed and the tile taken out and put on a rack for drying. It is allowed to stand for one month before being used.

Instead of the various designs, broken marble sometimes gives a mosaic effect, while marble being used in red cement and red marble in gray or yellow cement. The colors are bought in France and cost about $4.54 per 100 pounds, with the exception of green, which costs $31.75 per 100 pounds. From red, yellow, and black other colors are produced.

The cost of cement is about $12 per metric ton and of sand $1 per cubic yard. Most of the work is done by women, who receive 30 to 40 cents per day. The men who work in the factories receive an average of 80 to 90 cents a day. There are four factories engaged in the manufacture of these tiles, as the demand is large. Practically all floors are now made of this material. The tiling is laid so as to give the effect of a rug, and during the summer no carpets are used. By the use of a little oil, the floors may be polished like hardwood floors.

Other articles made of cement are balustrades, supports for balconies, pipes, bathtubs, washbasins, feed troughs, park benches, statuettes, and gravestones.

CEMENT COMPANY BUYS TWO VESSELS.

Officers of the Huron Portland Cement Company, Alpena, Mich., have formed a corporation with nominal capital of $100,000, and have purchased the small steamer Samuel Mather and the schooner Chickamauga, which will be put in service in the cement and clinker carrying trade between Alpena and Detroit during 1916.

The new corporation is the Huron Transportation Company.

SAVING IN TRANSPORTATION OF RAW AND FINISHED MATERIAL IN PLANT OF JEFFREY MFG. CO.

During the last few years much has been written and spoken relative to efficiency in so far as the manufacturing end of industries is concerned, but in few instances has the transportation of material in and about manufacturing plants received the attention its importance deserves.

Necessarily the transportation facilities of a plant include all the surface and overhead devices used in moving material from one point to another. In most instances large manufacturing plants present a rather difficult transportation problem. This is due to the unsymmetrical growth of plants, due to the fact that expansion was not anticipated.

The Jeffrey Manufacturing Company's plant in Columbus, Ohio, is spread out over an area of approximately 26 acres and has 18 acres of floor space. This plant manufactures a large and varied line of electrical locomotives, electric storage battery trucks, coal mining, elevating and conveying machinery of all descriptions, crushers, pulverizers, screens, etc.

Throughout the shops a high degree of efficiency has obtained for some time, but it is only during the last several years that transportation of raw and finished material has received adequate consideration. Formerly the raw and finished material was transported to and from cars in and about the various shops and departments by means of two-wheeled warehouse trucks, four-wheeled trucks and an industrial track. It was decided that storage battery trucks and industrial cars offered the best and most efficient means of surface transportation. Accordingly, the industrial railway was extended to take in all departments and a system of car dispatching was established.

It immediately was found possible to dispense with the services of a two-horse team, 28 two-wheeled warehouse trucks, 13 four-wheeled trucks, eight wheelbarrows and 18 men—an annual saving of more than $600 a month.

FERRO-CONCRETE RAILWAY FOOT-BRIDGES.

One of the most remarkable developments in structural work during recent years has been the wide adoption of ferro-concrete for structures of all kinds, says the Railway Times of London, England. That development has been slower in this country than in many places abroad, owing largely to old-fashioned conservatism, especially on the part of local authorities. Distrust of what may still be called the new material—the combination of concrete and steel is still new as compared with either concrete or steel separately or with stone, brick, and iron—has now practically died out because any doubter who investigated the matter was soon convinced of the enormous strength of ferro-concrete and of the ease and economy with which it could be applied. It has in all cases where space is a consideration the further advantage that walls and other structures may be thinner than if built of brick or masonry. Ferro-concrete is now being easily applied for the construction of foot-bridges over railways, and there is no difficulty in this direction, because large road bridges have been built of this material in different parts of the world. The day of wooden foot bridges over railways must now be nearly numbered,

Ferro Concrete Foot-Bridge Over Railroad.

as wood tends to get dearer and timber bridges require much attention to keep them in repair, especially in damp climates. The iron or steel foot-bridge also requires regular painting if it is not to get hopelessly rusted. Steel enclosed in concrete, however, is permanently protected from rust, and one may look for almost indefinite durability. Compression stresses are, of course, admirably taken by the concrete, while the steel is equally capable to stand the tension stresses.

A number of these ferro-concrete foot-bridges have recently been erected across English railways. A good idea of one of them may be obtained from the accompanying illustration, which shows a bridge over the London & Southwestern Railway at Bollo Lane. This and other bridges of the sort have been erected from the designs of Messrs. L. G. Mouchel and Partners, C.E., 38, Victoria street, Westminster, who specialize in Hennebique ferro-concrete. A glance is sufficient to show the permanent nature of the construction. The following brief description of this bridge may be taken as in principle typical of others. This bridge was built for the Richmond (Surrey) Corporation by Messrs. S. N. Soole and Son, Richmond, under the direction of Mr. J. H. Brierley, the borough engineer. The structure comprises a main girder span of 84 feet between the supporting columns, with a stairway at one end, and an approach girder span of 32 feet 9 inches, with stairway at the other end, the approach being continuous with the main portion of the bridge. The two continuous girder spans are supported on a group of four ferro-concrete columns at each end, with a pair of intermediate columns between the approach and main spans.

The stairway at the right-hand has seventeen steps, and eight steps are formed on the sloping deck of the approach span. The left-hand stairway is in two flights, of seventeen and fifteen steps respectively. The bridge spans consist of two ferro-concrete girders spaced 6 feet apart, and constituting parapets, which are connected by ferro-concrete decking, 4 inches thick, paved with asphalt. Each girder has tension and compression flanges, 8 inches wide, connected by a 3-inch panelled web with vertical stiffeners, spaced from 3 feet to 4 feet apart, the girders in the main span being of the bowstring type. Wind bracing is provided near the middle of this span by two 8-inch by 8-inch transverse struts, and a ferro-concrete smoke hood has been constructed over the center line of each railway track. The bridge is also of interest as including the longest girder span constructed in the United Kingdom, although ferro-concrete arches over much greater width have been built in various places.

The standardization of many different ferro-concrete structures on railways, such as the foot-bridge described herein, has been effected for some years past in the United States of America. As an instance of this the Kansas City Terminal has built reinforced concrete columns, deck slabs, and cross girders for all bridges—especially those under the railway. These were turned out of a so-called "slab-yard."

INVENTOR OF ROTARY KILN DEAD.

Dr. George Duryee, who invented the rotary cement kiln, died at East Orange, N. J., early this month, at the age of 82. He was born in Terry, N. Y., and for nearly 40 years practiced medicine in Buffalo. Becoming interested in several cement enterprises he gave up his practice about 20 years ago. Finding that improvements on the old-fashioned kiln were necessary to make progress in the cement making industry, he invented the revolving kiln and set up plants in different parts of New York state.

PORTABLE WAGON LOADERS.

Handling sand and gravel in the old hand-shovel way is hard work, and it is expensive. The past few years have proved that it pays to economize in the loading of these materials and today a light portable machine does the loading that formerly required 10 men.

The portable wagon loader consists of a steel framework, mounted on wheels, which supports a strong bucket elevator in such a manner that the bucket elevator can be pushed right into the base of a pile of loose material. The material is assisted to the bucket by the operator, and in this way capacities of from 25 to 100 tons an hour can be obtained, depending, of course, upon the nature of the material and general conditions.

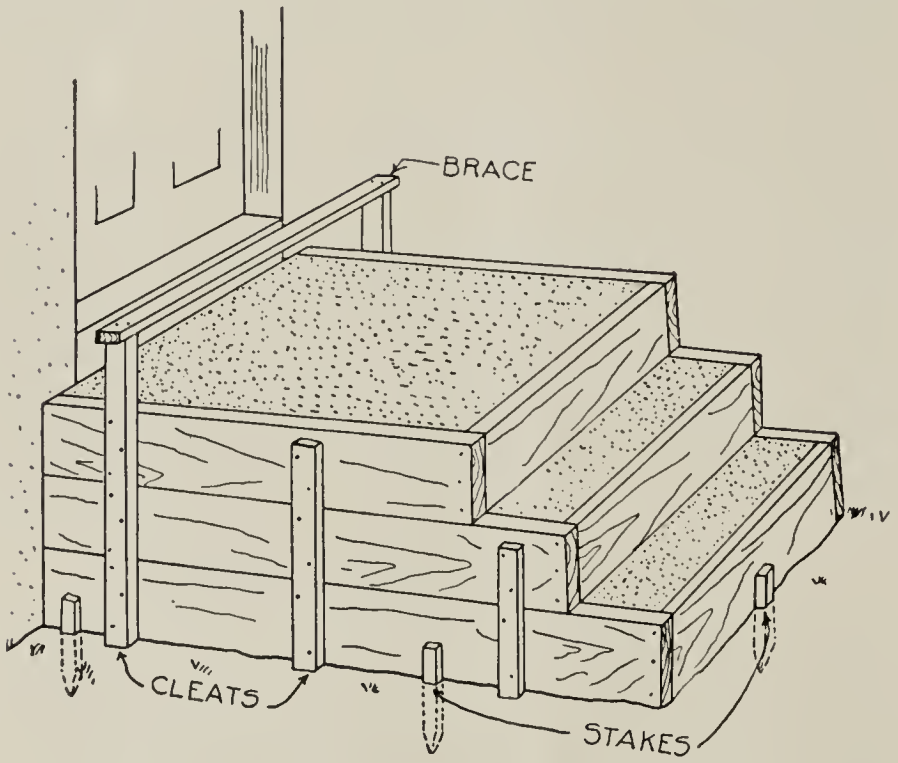
The newest portable wagon loader which has recently been completed by the Link-Belt Co., of Philadelphia and Chicago, is constructed along the same lines as described above, with the addition of self-propelling mechanism for driving in either direction. It is fitted with a platform on which the operator rides, and a steering wheel to control the direction of travel. It can be used to handle coal, stone, gravel, sand, cement, rock and clinker. With the Link-Belt loader one can load a ton of coal per minute—or a 5-ton truck in less than five minutes. The flight conveyor at the end feeds the material with regularity to the buckets and usually takes the place of a shoveller at this end.

The portable wagon and truck loaders are described in Link-Belt (Chicago or Philadelphia) Booklet No. 250. Copies will be mailed on request.

SIMPLE CONCRETE STEP CONSTRUCTION

Steps are not only subject to hard usage, but when constructed of wood with the lower part in contact with the ground and subject to alternate wetting and drying, decay is very rapid, making them unsafe and dangerous. Steps at the rear or kitchen entrance of the house encounter especially hard usage, but it is a very easy matter to have them durable and safe by constructing them of concrete. A simple method of doing this is shown in the accompanying drawing. The three forms consist merely of that many boxes open at top and bottom and also at the end adjoining the door-sill.

A rise of 8 inches and a tread of 10 inches will be found convenient. For this reason the height of each box should be 8 inches, since every box will form a step. All of the boxes should be of the same width, but each one is 10 inches shorter than the one beneath it, thus forming the tread of the step. If the steps are few in number and not too wide, 1-inch boards will be stiff enough to hold the concrete without bulging, but



Simple Forms for Constructing Concrete Steps.

if there is any doubt about this it is better to use 2-inch plank. The concrete for the steps should be mixed in the proportion of 1 bag of Portland cement to 2½ cubic feet of clean coarse sand to 4 cubic feet of crushed rock or pebbles. The earth beneath the steps should be excavated to a depth of 6 inches below the surface, the excavation being the exact size of the bottom of the steps. Make sure that the earth is level and compact at the bottom of the excavation. Place the largest box in position around the edge of the excavation, staking it in place at two or three points to prevent shifting. Level the first box very carefully by means of a carpenter's spirit level. The concrete, mixed rather dry, should be deposited in the box and thoroughly tamped and compacted until moisture rises to the surface. Work or spade the concrete thoroughly along the sides of the forms so as to produce a smooth surface. At the front end of the box, where the concrete becomes the tread, the surface of the concrete is carefully leveled off and smoothed with a trowel for a distance of about twelve inches from the outer edge. Immediately after this is done the second and smaller box is placed on top of the first one, being fastened thereto by a few nails through the upright cleats shown in the drawing. The nails must not be so long as to project through the forms and into the concrete. Fill the second box with concrete immediately, being careful that no dirt or other foreign matter falls or collects on the surface of the first batch of concrete, as this would prevent a good bond between the two layers. Finish this step or slab in exactly the same manner as described for the first step. The last or third step is constructed in exactly the same manner as those previously described.

The brace between the two back cleats is for the purpose of preventing the boards from spreading at the side next to the wall. The outer surface of the top step is carefully leveled off with a straight-edge and finished by troweling to a smooth surface. Excessive troweling, however, must be avoided. Not more than a half hour should elapse between placing the concrete for each step so that the concrete first deposited will not harden and set up before the next form is filled. After the steps are about one week old, the forms may be removed and the steps used. After the forms are removed any roughness or irregularities may be smoothed down and the surface of the entire steps finally finished by rubbing with an old piece of emery wheel and water or carborundum and water. Where the work includes many steps, a hollow space is generally left under the main body of the steps to effect a saving in materials. Where this is done the platform and steps are reinforced with steel rods or heavy wire mesh to prevent cracking.

USING A WATERPROOFING COMPOUND WITH LEAN STUCCO MIXTURES.

Permanently satisfactory stucco work is an end toward which contractors have been working for some time, and many different opinions exist as to the best mixture for stucco. The Standard Paint Co., 575 Woolworth Bldg., New York, N. Y., in a cricular recently sent out, calls attention to what is, in its opinion, the necessity of using leaner mixtures in stucco. This company manufactures "Impervite," a waterproofing compound, and recommend its use in stucco mixtures. The following paragraphs are quoted from its recent circular:

"Outside of settlement cracks, the chief cause of disintegration of stucco is the alternate expansion and contraction due to wetting and drying out. It has been proven that mortar contracts on drying (and expands on wetting) just as lumber does. This action keeps up for years, and is one of the principal causes of cracking, especially in stucco. It is the cement, however, which is affected, and not the sand; therefore, if the cement is diluted with a large proportion of sand the total effect is greatly reduced.

"Experience shows that a plain 1:3 stucco, properly applied, is safe from cracking, but is very porous. A 1:2 stucco, however, while less porous, is very much more liable to crack in spite of the greatest care in workmanship.

"This, then, is the dilemma which confronts the constructor; how to make a stucco lean enough to avoid cracks, yet non-porous enough to keep out water. The problem has been solved by the use of 'Impervite' as a waterproofing agent with a 1:3 stucco."

The leanness of the mortar prevents cracks, and the "Impervite" makes the mortar waterproof. This gives, the manufacturers claim, reliable results, both as to permanency of surface and permanency of waterproofing. Send a postal to the Standard Paint Company, 572 Woolworth Bldg., New York City, for their Booklet.

Economic Operation of Sand or Gravel Pits

By Russell J. Borhek, President.

Tacoma Sand & Gravel Company, Tacoma, Wash.

The average sand and gravel pit has considerable waste material, which by proper methods of treatment might be turned to some use; not only as salable material but also by increasing the value of the output.

The writer has recently finished some investigations, examining the output of twenty pits, and finds that for each source there is some definite proportions of combining the waste (undersize, oversize or surplus of any size) with the salable material that in most instances the entire pit output can be used and the grade of material increased so as to give a very dense mixture with a low percentage of voids.

Proper methods of screening and combining will often effect savings of 10 to 20% in the amount of cement used; the graduation of the particles being such that the combined aggregates are very dense and as a consequence require less cement for a given strength. Should the sand and gravel be exceedingly fine a proper combination of materials may be obtained to give excellent results.

Should the sand and gravel be exceedingly coarse the same proper combination may be effected, although more difficult to do in this case on account of the lack of fines in the sand. Skipping intermediate sizes, using an excess of larger aggregate, combining the right quantity of coarse sand with the fine sand, in general the assembling and re-assembling of the materials in the correct proportions to give maximum density and a low percentage of voids and the waste products will be negligible.

This all requires mechanical analysis of both materials, a close check kept on the output and repeated trials for density mixtures. A re-arraignment of screening and separating devices may be necessary at the same time; astonishing results can be had. Sands containing 33% voids were so combined as to give as low as 28%.

Gravels having 33% voids we combined and gave 29%.

The combined sand and gravel in proportion 1:2 gave for the coarse gravel and sand.....15 % voids
Medium gravel and sand.....16.4% voids
Fine gravel and sand.....18.2% voids
Sands were produced having as low as...24.5% voids
Gravels were produced having as low as..27.0% voids

Should a crusher be operated in connection with a pit the grading can be so effective that the combined aggregates have as low as 12% voids by the addition of the proper amount of very fine material.

The above results can be obtained in the pit operation and materials of such quality delivered directly into the bunkers without any weighing or measuring devices. The difficulty heretofore had been the lack of appreciation as to just what could be done by properly combining the fine and coarse aggregates. Present practice is not only costly but wasteful and the time is rapidly approaching when graded aggregates will be called for in important work.

The writer might also state that there seems to be definite combining proportions for different gravels and sands on account of the coarseness or fineness, roundness, roughness or regularity of particles. Of the twenty investigations he has made only 6 conditions were anywhere similar, and not to a considerable extent.

MACKINAW SAND AND GRAVEL COMPANY.

The offices of the Mackinaw Sand and Gravel Company, which have, for the past year been located in Peoria, Ill., will be re-established in Lincoln, according to announcement made by officers of the firm. This company, one of the largest of its kind in the state, is owned and officered by Lincoln men, and has enjoyed a remarkable growth in the past year. At the present time two sand and gravel pits are operated by the concern, one at Chillicothe and one at Mackinaw.

The Mackinaw plant is located near the I. T. S. and Big Four railway tracks at Mackinaw. In 1912, the old equipment having been found inadequate to turn out enough sand and gravel to meet the demands, was replaced by a modern washing and screening plant at an approximate cost of $20,000. The Mackinaw was the first gravel washing plant to use a drag line excavator in connection with rotary screens.

A high pressure Morris centrifugal pump forces five hundred gallons of clean water through the material while it is in the process of screening. The sand and gravel is thus absolutely clean when deposited in the storage bins.

In 1914, James W. McGrath and T. E. McGrath bought the interests of Walter Porter and W. H. Evans and organized a stock company. At this time the large deposits at Chillicothe were secured. The combined capacity of the two plants is approximately 2,300 tons per day or about 50 cars.

FRED C. SMITH, NOTED BUILDER OF CONCRETE PAVEMENTS, NOW WITH CAREY COMPANY.

Fred C. Smith, formerly city engineer of Sioux City, Iowa, was renewing old acquaintances at the Chicago Cement Show.

Mr. Smith now lives in Cincinnati, being associated with the Philip Carey Company of that city. He was demonstrating the practicability of the Carey Elastite expansion joint, and showing the people how to build good concrete pavement.

Engineer Smith is the ideal man for this kind of work, for he has built some of the best concrete pavements to be found anywhere, and in so doing he assisted in the development of this joint which he was demonstrating at the cement show.

Mr. Smith is emphatic in his declaration that the best men obtainable should be put on the job of finishing concrete paving. It will pay in the long run, he says, in the lower maintenance charges made necessary.

HEADQUARTERS OF CEMENT MANUFACTURERS' ORGANIZATION CHANGED TO CHICAGO.

The headquarters of the Association of American Portland Cement Manufacturers have been removed from Philadelphia to Chicago, where offices have been established at 111 West Washington street.

Not only the general activities of the association, but resources for extending its services to engineers, contractors and every class of cement users have been increased, and the association extends to all who are interested in concrete construction a cordial invitation to visit the offices.

AMERICAN ROAD BUILDERS' ASSOCIATION.

150 Nassau St., New York, N. Y.

Col. E. A. Stevens, State Commissioner of Public Roads of New Jersey, was elected president of the American Road Builders' Association at its annual meeting held at the Automobile Club of America, New York, N. Y., on Friday, February 4. Other officers were elected as follows: First vice-president, Arthur W. Dean, chief engineer, Massachusetts Highway Commission; second vice-president, Austin B. Fletcher, State Highway Engineer of California; third vice-president, William H. Connell, chief, Bureau of Highways and Street Cleaning, Philadelphia, Pa.; secretary, E. L. Powers, editor "Good Roads;" treasurer, W. W. Crosby, consulting engineer, Baltimore, Md. Directors for three years were elected as follows: William D. Uhler, chief engineer, Pennsylvania State Highway Department; R. A. Meeker, State Highway Engineer of New Jersey; Governor Charles W. Gates of Vermont; R. Keith Compton, chairman and consulting engineer, Paving Commission, Baltimore, Md.; James H. MacDonald, former State Highway Commissioner of Connecticut; Frank M. Williams, State Engineer and Surveyor of New York.

At the dinner held in the Automobile Club's banquet room at half-past six, Nelson P. Lewis, chairman of the Executive Committee of the Association, made the principal address.

Retiring President George W. Tillson, who acted as toastmaster, spoke briefly of the Pan-American Road Congress and the road work in the West. Colonel Stevens, the incoming president, acknowledged his election and spoke at some length on technical phases of road building, putting special emphasis upon the necessity of proper records. In closing his remarks, he called attention to the necessity for including data on speed in traffic records. Other speakers were Charles Whiting Baker, of "Engineering News;" H. W. Swetland, of "The Automobile," and Elmer Thompson, secretary, Automobile Club of America. Mr. Baker congratulated the Association and Colonel Stevens upon the election of the president and touched upon the subject of federal aid. Mr. Swetland called attention to the necessity for building roads for automobile traffic instead of for horse-drawn traffic, and proposed for New York City a north and south elevated roadway for automobile traffic. At the suggestion of former State Highway Commissioner MacDonald of Connecticut, at the close of the speaking, rising votes of thanks to the Automobile Club of America for its hospitality and to Mr. Tillson for his work as president during 1915 were taken.

DEALERS WANTED.

The Sandusky Portland Cement Company, Cleveland, Ohio, want representatives in every city and town in the United States, to handle Medusa Waterproofing, Medusa White Portland Cement and Medusa Waterproofed White Portland Cement. This action is necessary on account of their extensive advertising campaign, which is bringing thousands of inquiries from every section of the country.

This is truly a rare opportunity for a dealer to add these well-known materials to the builders' supplies he is now handling, and their sales co-operation plan will enable the dealer to greatly increase his profits without charge to him.

WISCONSIN CRUSHED STONE ASSOCIATION.

The Wisconsin Crushed Stone Association, recently formed, has organized, by the election of A. J. Blair, Milwaukee, president; J. J. Sloan, Red Granite, Wis., vice-president; Leatham D. Smith, Sturgeon Bay, secretary and treasurer. There are thirty-eight crushed stone operators represented in the membership, which is all but four of those in the state.

NOT AFFECTED BY SILAGE ACIDS.

The objection has often been raised against cement that it is affected deleteriously by the acids in the silage. This contention has never been proven and there are numberless authoritative statements to the contrary. It might be pointed out, however, that even if there should be a slight eating away of the concrete by these acids, such action can effectually be counteracted by some asphaltic or bituminous preparation once every three or four years. If such a coating as this is considered necessary, this is practically the only item of maintenance cost which it will be found necessary to expend upon the silo other than perhaps occasional renewing of the roof, unless a concrete roof should be put on in the first place. Concrete, therefore, admirably fulfills the requirements of low maintenance cost.

One of the manfacturers of concrete silos has gone to considerable trouble to gather expressions of opinion from the various agricultural colleges regarding the concrete silo. A statement was especially asked on the question of the effect of the acid in silage on concrete, since this is one of the main arguments used by the opponents of concrete silos. Some of these expressions are as follows:

It has been our experience on the college farm, and the experience of the men for whom we have supervised the construction of cement silos, that when properly built they preserve silage in first-class shape. We have never noticed the effect of the acid of silage on the walls of a concrete silo.—O. E. Reed, Professor of Dairy Husbandry, Kansasa State Agricultural College, Manhattan, Kansas.

I think it has been definitely established that among all types of silos the concrete silo is one of the most durable. The action of the acid in the silage on the durability of the concrete is not a large factor in any event, and when the silo lining is covered with a proper glazed coating, this action is practically negligible.—F. B. Mumford, University of Missouri, Columbia.

A silo, if made with impervous walls so as to exclude the air and retain the moisture, if made so as to be sufficiently rigid and of sufficient strength to resist the bursting pressure of the silage, and lastly if smooth on the inside to permit the silage to settle properly, will keep the silage regardless of the kind of material used in the construction. Concrete silos can be made to meet all these requirements. There is abundant evidence of this and in no case have we found spoiled silage in any silo where these essentials were incorporated.—J. B. Davidson, Professor of Agricultural Engineering, Iowa State College, Ames.

I have constructed quite a number of concrete silos and have found that when the concrete silo is constructed properly it will preserve the silage in good condition. I have also found that the acid of silage has very little effect on the concrete.—J. W. Ridgway, Professor of Dairy Husbandry, Agricultural and Mechanical College of Texas, College Station.

Concrete silos on the whole will keep silage as well as any other silo. With concrete walls made of properly proportioned and well mixed cement, sand, gravel, and the inside washed with grout, one need not fear injury to the walls due to the acids in the silage. I have examined quite a number of concrete silos and have not seen a single one where the acids have made any permanent injury to the walls. It is my opinion that the effect of the acids in silage on a concrete wall is a minor matter.—C. F. Chase, Assistant Professor Agricultural Engineering, North Dakota Agricultural College.

It is my opinion that concrete silos keep silage as well as other makes, and that when the concrete of the silo is

properly glazed the acid in the ensilage does not have any injurious effect upon the concrete.—W. L. Fowler, Head Department of the Animal Husbandry and Dairying, University of Arkansas, Fayetteville.

There is positively no truth in the statement that cement silos are destroyed by the acids in the silage. These silos have been in use for about twenty years. A few days ago I was talking to a gentleman who had just examined a stone silo that was plastered with cement plaster twenty-five years ago and had not been repaired since, and it is now in perfect condition. We have seven of these concrete silos on the college farms that are keeping silage fully as well, if not better, than our two wooden silos.—A. S. Neale, Dairy Husbandry, Kansas State Agricultural College, Manhattan, Kansas.

A great many objections are made to concrete as a suitable material for silo construction. These statements, of course, come from competing builders, mostly wood stave silo people. Observations of concrete and wood stave silos standing side by side show that the freezing is not greater in one than the other. By coating the concrete walls with a wash of neat cement or tar pitch they can be made perfectly air, water and acid proof. That concrete stave silos are a success has been demonstrated beyond a doubt by those built, not only in this state, but other states as well. Silos of this type are known to have been used successfully for eleven years without the least sign of deterioration, or loss of silage through spoilage.—Agricultural Experiment Station, Ft. Collins, Colorado.

Concrete silos have been in use for at least fifteen years in this state, and are giving excellent satisfaction. There is no serious effect of the silage acid on the concrete.—F. M. White, Department of Agricultural Engineering, University of Wisconsin.

Concrete can very readily be made round in shape. It is the most plastic material of any with which the silo builder will have to deal, and can be fitted perfectly to his requirements in every way.

Concrete can be given absolutely smooth interior walls. In monolithic silos, the walls will automatically assume a smooth surface if proper care is taken, even without any surface treatment; while where concrete units are used, these form an admirable surface on which to plaster or to apply any smooth surface coating.

In addition to concrete there are five materials which are sometimes used for the construction of silos—stone, brick, structural tile, wood and iron.

ELLIS SOPER GETS NEW JOB IN CUBA.

A leave of absence until April 1 was granted Ellis Soper, engineer of construction on the new Market street concrete bridge, Chattanooga, Tenn., by the county bridge commission. Mr. Soper will leave for Cuba in a few days, where he will take up the duties of designing and construction engineer for a syndicate of New York capitalists who are undertaking large industrial enterprises on the island.

Interviewed in this connection, Mr. Soper stated that he has no intention of resigning, but is willing to place a competent engineer in his place and make a monthly trip of inspection to Chattanooga until the bridge work is completed. The commission, however, will not require the appointment of a substitute before March 1, as little work is being done on the bridge on account of the high stage of the river. In the meantime the county engineer, L. B. Bryan, will act in a general supervisory capacity to protect the interests of the country.

Theodore King, chairman of the bridge commission, states: "I regret to see Mr. Soper go. He has done excellent work. The position offered him, however, offers a salary of more than twice that which he is drawing here, and I cannot blame him for accepting it.

View of New Cement Mill Which the Universal Portland Cement Company Is Building in Duluth, Minn.

This Modern Portland Cement Plant is being equipped with the most modern machinery. All of the rotary kilns, all of the tube mills and all of the electrical equipment was furnished by

Allis-Chalmers Manufacturing Co.

End Discharge

Mixers can be used more economically for

General Concrete Work and Paving

Built in 2 sizes. 8 and 10 ft. capacity.

BOSS HIGH SPEED MIXERS

Discharges entire batch in 12 seconds.

Carried in stock in all principal cities.

Built of steel, saving 3,000 pounds weight, yet 30% stronger.

Hyatt Roller Bearings — High Speed Mixing Action

Write, 'phone or wire for address of dealer near you with mixers in stock

The American Cement Machine Co., Inc.

9635 Johnson St., Keokuk, Iowa

$297 Buys This Low Charging 10-ft. Mixer.

Mixes Concrete — Mortar — Plaster

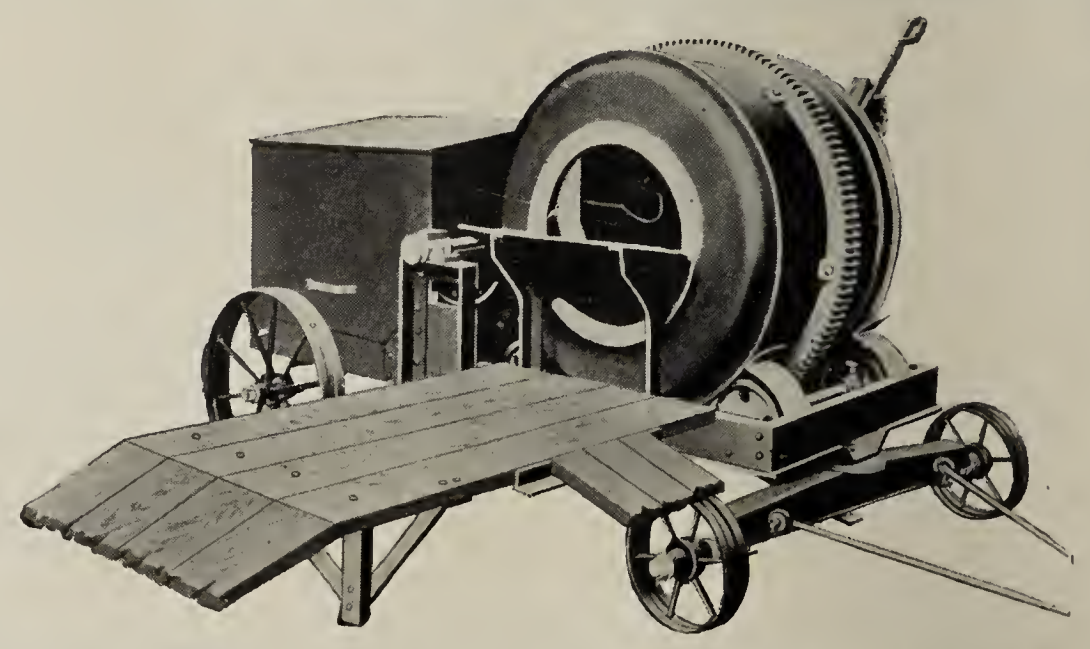
For Mixers with 4 H. P. Engine (enclosed type)

BUILT OF STEEL

Sold under iron clad money back guarantee.

$425 complete with power loader and measuring water tank.

Get the catalog showing full details.



The American Cement Machine Co., Inc. (Packard Division B) Keokuk, Ia.

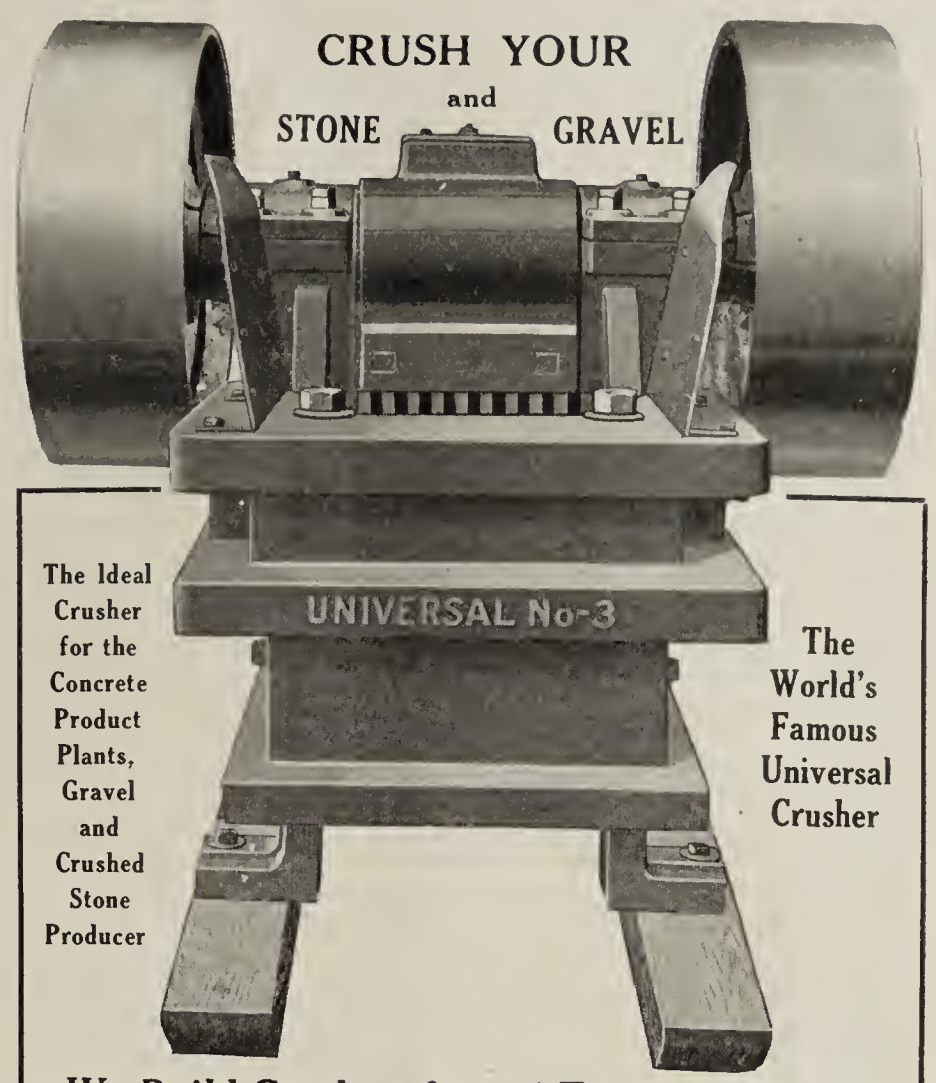
A NEW LANSING CONCRETE MIXER.

No doubt many a building contractor doing country work has been greatly disappointed in not being able to purchase just what he wanted ever since concrete mixers were first placed upon the market, namely a high-wheeled wagon-tread mixer. He justly claimed that if the manufacturers of mixers had to take their machines over the rough country roads from one job to another his needs would soon be recognized and supplied. With this ever-increasing demand therefore in mind, the Lansing-Company, Lansing, Mich.. has placed on the market what is known as the "Lansing No. 5 Roadster," a general view of which is presented on this page. This is a 5-ft. split bag machine. It has front wheels 24 in. in diameter and rear wheels 30 in. in diameter that follow a wagon track. It has in fact all the ear-marks of the larger and well-known Lansing mixers and is equipped with either side loader or batch measuring hopper, a rotary pump, silo hoist or folding platform. The side loader feature is the open end type, and is said to be the first open end skip ever placed on a small side-discharging machine. The company points out that it has plenty of power and this, coupled with a minimum low weight, renders it a desirable machine for country use. The motive power may be an Ideal or Novo engine, according to preference. Write for their Catalog 354-M.

ATLAS CEMENT COMPANY.

Mr. A. G. Croll has been appointed to act in capacity of general superintendent of the Atlas Portland Cement Company with headquarters at New York. Mr. W. H. Baker has been made assistant general superintendent, western district, with headquarters at Hannibal, Mo.

CRUSH YOUR STONE and GRAVEL



The Ideal Crusher for the Concrete Product Plants, Gravel and Crushed Stone Producer

The World's Famous Universal Crusher

We Build Crushers from 5 Tons to 300 Tons per 10-hour Capacity

Instantly adjusted to produce size required from ¼ inch to 3 inches. *Write for Folder No. 14.*

UNIVERSAL CRUSHER COMPANY

230 Bee Ave. Cedar Rapids, Iowa, U. S. A

The New

Lansing Roadster

The Mixer for the Country Contractor

BECAUSE:

It has **24-inch front,** and **30-inch rear,** wheels.

It **follows the wagon track.**

Its **hammock bearings** absorb the bumps in the road.

Its power plant is the best mixer engine on earth—**Novo** or **Ideal.**

All wheels and bearings have **hard oil cups.**

You can have it with **sideloader** or **batch hopper, water tank** or **folding platform.**

For bridge builders it has a **rotary pump.**

For silo men it is equipped with **special silo hoist.**

The **weight is light.**

The **price is right.**

Ask about the ***Lansing Roadster,*** *Catalog 354-M.*

LANSING COMPANY

"KEEP YOUR PRODUCT ON WHEELS"

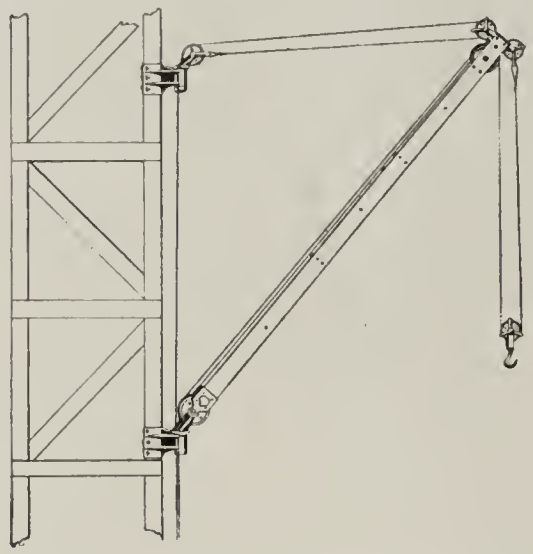
LANSING, MICHIGAN, U. S. A.

CHICAGO, 169 W. Lake St. PHILADELPHIA, Willow and N. Amer. Sts. NEW YORK, 288-289 West St.
MINNEAPOLIS, 517-519 N. Third St. SAN FRANCISCO, 338-348 Brannan St.
KANSAS CITY, 1413-1415 W. Tenth St. BOSTON, 78 Cambridge St., Charlestown Dist.

The Home of the Lansing Wheelbarrow

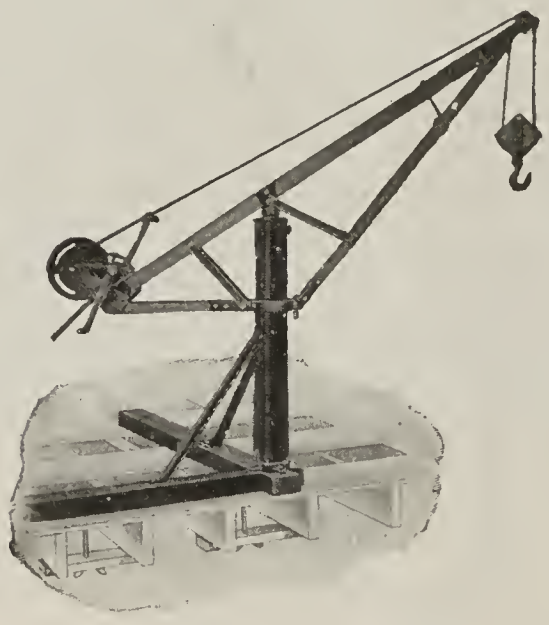
SASGEN PORTABLE BUILDERS' DERRICK

Of the many products of the Sasgen Derrick Company, 2052 North Racine avenue, Chicago, their new steel Champion Portable Swing Builders' Derrick is among those that are attracting special attention. It seems to fill a long felt want. It can be operated by hand, horse or power. It weighs only 200 pounds, and has a capacity of 1,000 pounds. It is 7½ feet in height and the boom extends 5 feet. The boom can be removed in a few seconds by loosening one nut and raising boom two inches. The bottom sills and mast fold together, making the derrick in two parts, compact enough for the contractor to take the derrick from one job to another in an automobile.



Sasgen One-Ton Power Tower Boom with All Steel Fittings Arranged so That the Boom Can Swing Full Three-quarters. Load and Boom Can Be Raised by Power or Boom Can Be Fastened by Cable to the Top Tower Bracket and Load Hoisted by Power.

For loads up to 1,000 pounds this steel Champion is credited with unexcelled performances. So well satisfied are the manufacturers with it that they say they will ship the machine to reliable contractors on trial.



This, however, is but one of many derricks and similar goods manufactured by this company. Their line of derricks include the Sasgen Setter derricks, Sasgen Pole derricks, Sasgen "A" Frame derrick, Sasgen Peerless Circle swing steel derrick, Sasgen Standard Circle swing builders derrick, Sasgen Circle Double Boom wheelbarrow derrick, Sasgen Stiff Legged derricks, Sasgen Circle Swing counterweight derrick, Sasgen Tripod and Twin Setter derrick, etc. In addition they manufacture material elevators and an extended line of winches, grabs and similar appliances.

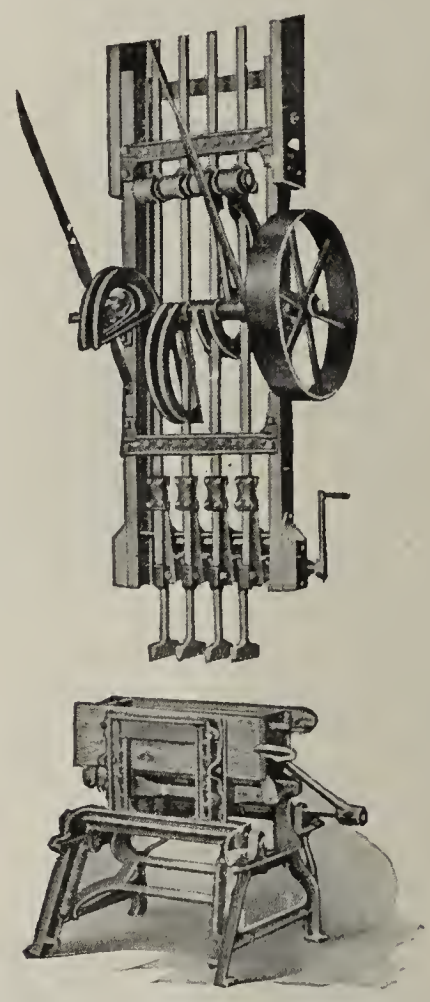
In their new Catalog No. 15 just issued by the Sasgen Derrick Company these various products are illustrated and described. A copy of Catalog No. 15 will be mailed you by mentioning Cement & Engineering News.

MILLER'S AUTOMATIC TAMP.

Readers of the Cement and Engineering News will, we are sure, be much interested in an automatic Tamper of efficiency and durability, and of such simple design that it can be built and sold at a price within reach of the small contractor or block manufacturer. It is the product of the J. C. Miller Block Machine Co., 114 W. Clark Street, Jackson, Mich., makers of the well-known "Block King" Concrete Block Machine.

This tamper, as the picture suggests, is simplicity itself, having no chains, sprockets, or other complicated mechanism of any kind about it. The cut shows four tamping units; but a greater or less number may be used, depending on the requirements of the mold the tamper is used over. Square steel rods are used which cannot turn out of alignment. Each rod, with tamper end, weighs 45 lbs.

The operation is merely the lifting of each tamping unit, which falls of its own weight with a force of about 750 lbs.—many times greater than is possible by hand tamping. These tamping units are lifted and dropped about once every second; so it will be clear that with such tamping facilities, blocks of great strength and density can be produced at a very rapid rate and at a greatly reduced cost for labor.



Miller's Automatic Tamp Installed Over Block Machine.

The cam which lifts the tamping rods engages on both sides of rod so that the lift is straight, thus reducing friction and wear. The question of wear has been carefully studied, and reduced to the minimum by proper design and perfect balance of the working parts. An extremely clever and positive lock washer is used on all bolts, to prevent them from becoming loosened as a result of the constant jar and showing that this concern believes in "safety first."

Each tamping bar is instantly adjustable up or down so as to allow for special cores or an L-shaped block. In fact, almost any kind of block may be tamped with this Miller-Tamper, and it can be fitted over any make of block machine. The machine takes up no floor space and very little other space, and is easily operated with 1½ horse-power. It can be operated while workmen are filling the mold, thus consuming no extra time for the tamping process and no labor whatever except the movement of a lever.

All who are interested in block or brick machinery, automatic tampers, mixers, etc., should write the J. C. Miller Block Machine Co., 114 W. Clark Street, Jackson, Mich., for their catalogue.

DYNAMITE FOR EXCAVATING AND LOOSENING MATERIAL.

Mr. Marsh, a Colorado blaster, advises us that he has blasted pole holes for a gas and electric company; also blasted out a cellar of the new State Teachers' College in his locality; also blasted a new reservoir for the water works, all of which proved very successful.

All of these are classes of work which few professional blasters seek, yet such work pays well and can be secured at seasons of the year when there is nothing to be had from farmers.

Blasters should be on the lookout for all kinds of work that can be done with dynamite. Blasting has many advantages over labor in disposing of clay banks, blasting gravel in gravel pits, well digging and excavating of all kinds. Sometimes the cost of blasting would be greater than the cost of using manual labor. In other cases, the cost of blasting would be less. However, even when the cost is greater, speed at which the work can be done is oftentimes a factor and if quick work is the object, dynamite is the only solution of the problem.

Aside from the question of cost and speed, labor is not always available, and even though the cost might be a little less if laborers with picks and shovels were employed, employers will often be found willing to pay more to have the work done with dynamite because of the scarcity of labor. Blasters should not overlook any of these arguments.—Dupont Magazine.

WHY NOT PEBBLES?

When authorities disagree, there is perhaps excuse for wide differences in individual interpretation of the meaning of a particular term. Since dictionaries are not entirely in accord, it is not surprising that the individual misinterprets the meaning of "gravel," from the standpoint of its necessary requirements for concrete aggregate. This fact is often responsible for the use of bank-run material, as there are definitions for gravel which describe it as "small stones or pebbles, or a mixture of sand and small stones." There is no definite differentiation between cobblestones and boulders, as regards minimum and maximum limits of size. Bank-run deposits may contain particles large enough to fall within the common conception of either, to say nothing of the presence of foreign matter, such as clay and loam, that render the material unfit for concrete aggregate. Why not use a term that would suggest a clean material as well as one consisting of particles fairly well limited as regards minimum and maximum size? Pebbles, in the minds of most people, are clean, rock particles made so by attrition in streams or otherwise. If "pebbles," ranging from a certain minimum to maximum, were specified as coarse aggregate, such specification would immediately carry the idea of cleanliness and freedom from particles below and above a certain minimum and maximum. As such material cannot be found in a natural deposit, the specification of pebbles would imply the necessity for preparation, thus rendering the material fit for use as concrete aggregate.

The Man Doesn't Live

who can look at the Hall Interlocking Concrete Culvert and say it isn't a Regular (Everlasting) Culvert. Engineers and roadmakers are looking for Culverts that will stand up and are not prohibitive in cost.

This Means Something to Contractors who want to make money the year round. Under our system you need not buy patent-rights or a lot of expensive equipment. Exclusive contract on county or district; we help you get the business, and back you with a guarantee of profits.

THE CULVERT EVERLASTING

We want only one live man in a county—Our folder ***H-6*** is ready.

SCHULZ & HODGSON

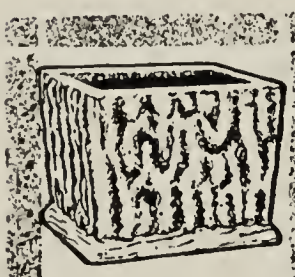
948 Association Bldg., :: :: CHICAGO

Cement Block Machine, $40.00

Makes three styles and all sizes Capacity 150 blocks daily. Special off-bearing system prevents cracking and breaking.

Concrete Vase Mold $15

Very attractive style of vase. Mold is simple to operate, neatly designed and accurately constructed. Two sizes. Fully described in Ornamental Mold catalog.



Concrete Rustic Flower Box Mold, $10

Attractive design. Made in several sizes. End and side plates are interchangeable for the different sizes. Fully described in Ornamental Mold Catalog.

Concrete Flower Box Mold, $15.00

A very desirable and popular style. Very attractive for any porch, post, lawn, etc. See Ornamental Mold Catalog.

DRAIN TILE —a *Paying* Business

However you consider the tile business, IT'S GOOD. It is less of a gamble and more of a certainty than any branch of the concrete business.

Materials are cheap and abundant; manufacturing is simple; competition is not to be feared; the product is in great demand; the initial investment required is comparatively small; and **profits range from $230 to $800 a month—conservatively figured.**

These are straight-from-the-shoulder facts, without exaggeration or misstatement. If you want printed proof write for complete data.

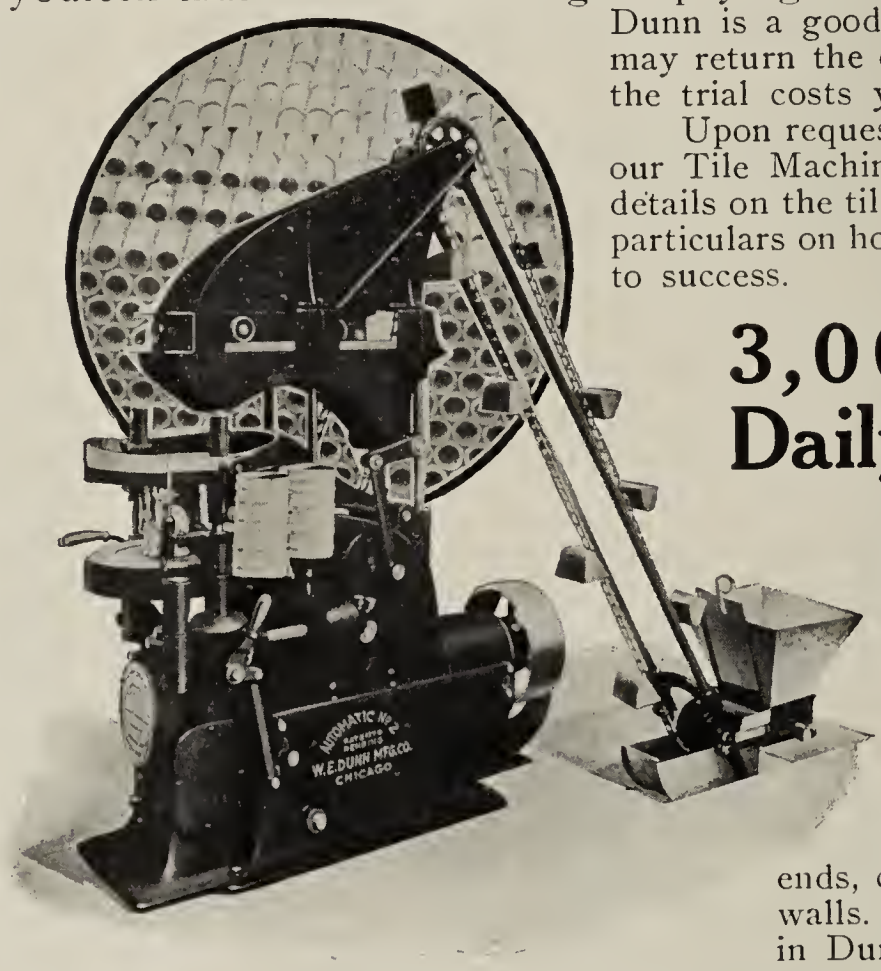
Dunn No. 1 Til Machine - $16

Capacity 1,500 to 2,0(tile daily. Operated by 2 or 3 men. Makes a sizes from 3" to 12" dian eter. Waist high tabl triple-duty packer hea No overhead frames or a gle iron construction. A working parts enclosed the massive one-pie base.

We Help You Get Business

Here's our proposition: If you will promise to try out the tile business for two weeks, we will send a Dunn Machine and necessary equipment for you to use 15 days, absolutely without expense or obligation. Unless you convince yourself that cement tile is a good paying business, and the Dunn is a good machine, you may return the equipment and the trial costs you nothing.

Upon request we will send our Tile Machine catalog, full details on the tile business, and particulars on how we help you to success.



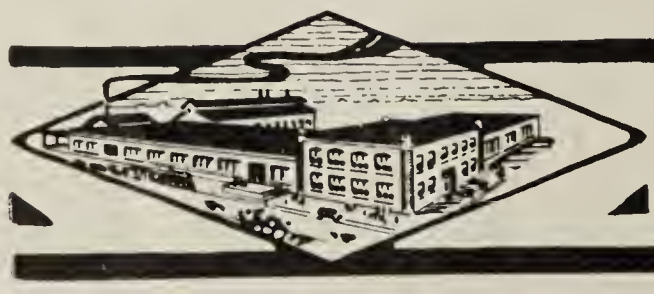
Dunn "Automatic"

3,000 to 3,600 Til Daily on the "Automatic"

Minimizes production costs makes the strongest, densest cemer tile ever produced. The logical ma chine for an established tile busines Makes tile 3, 4, 5, 6, 7, 8, 10, 12, 14 an 16 inches in diameter, at the rate from 3,000 to 3,600 per day. Speci automatic features reduces labor cost

Equipped with the Dunn Triple Duty Packer head which compacts th ends, cores out the center, and glazes the insid walls. Triple service of packer head is exclusiv in Dunn machines.

Write for special catalog and prices on the Dunn Automat



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CONCRETE DUNN FOR YOU MACHINERY

Residence of Mr. A. A. Atwater, Engineer, Cleveland, Ohio. Walls Built Entirely of Concrete Blocks.

The Manufacture of Concrete Blocks

Insurance rates, Fireproof Qualities, Mortar Joints, Prices, etc., Discussed. Progressive Manufacturers of Concrete Products Should Insist upon Building Laws.

Building construction in all communities should be under adequate regulations. Especially should concrete building units be defined and specified. Their manufacture is not standard—therefore the products are not standard. Those manufacturers of concrete units who are conscientiously trying to build up a permanent business by producing permanent material should demand that concrete products be required to measure up to a good standard of quality. The man producing units of high quality cannot hope to compete with the man who is producing poor units. It is cheaper to make poor products. The specifications of the American Concrete Institute, which are suggested below, and the recommended practice, are offered here at this time merely as a basis for a general consideration of the whole matter of proper building regulations.

Specifications for Concrete Architectural Stone, Building Blocks and Brick

Concrete architectural stone, building block and brick must be subjected to compression and absorption tests. The test samples must represent the ordinary commercial product of the regular size and shape used in construction.

Compression Test—(a) In the case of solid concrete stone, block and brick the ultimate compressive strength at 28 das. must average 1,500 lbs. per sq. in. of gross cross-sectional area of the stone as used in the wall, and must not fall below 1,050 lbs. per sq. in. in any case.

(b) The ultimate compressive strength of hollow and two-piece building block at 28 das. must average 1,000 lbs. per sq. in. of gross cross-sectional area of the block as used in the wall, and must not fall below 700 lbs. per sq. in. in any case.

(c) In the case of hollow building block the gross cross-sectional area shall be considered as the actual wall area including the block and air space displaced by the block.

(d) In the case of two-piece block the block shall be tested in pairs consisting of the front and rear block as used in the wall. The compressive strength shall be regarded as the sum total sustained by the two blocks divided by the product of the length of the block and the width of the wall.

Absorption Test—The percentage of absorption at 28 das. (being the weight of the water absorbed, divided by the weight of the dry sample) must not exceed 5% when tested, as hereinafter specified.

General—(a) Laboratory. All tests required for approval shall be made in some laboratory of recognized standing.

(b) Samples. For the purpose of the tests at least nine samples or test pieces must be provided. Such samples must represent the ordinary commercial product, and shall be selected from stock. In cases where the material is made and used in special shapes or forms too large for testing in the ordinary machines, smaller size specimens shall be used as may be directed.

(c) Tests. Tests shall be made in series of at least three. The remaining samples are kept in reserve in case duplicate or confirmatory tests be required. All samples must be marked for identification and comparison.

Compression Tests—The compression tests shall be made as follows:

(a) Solid concrete stone, block and brick. When testing solid concrete stone, block and brick, the net area shall be considered as the minimum area in compression.

(b) Hollow and two-piece building blocks. Whenever possible such tests shall be made on full sized blocks. Whenever such tests must be made on portions of blocks, both pieces of the block must be tested and both must contain at least one full web section. The samples must be carefully measured, then bedded flatwise in plaster of paris to secure uniform bearing in the testing machine and crushed.

The net area shall be regarded as the smallest bearing area of the piece being tested. The total compressive strength shall be divided by the net area to obtain the compressive strength in lbs. per sq. in. of net area of each piece. The sum of the two results shall then be averaged to obtain the average strength in lbs. per sq. in. of the net area of the total block.

The entire block shall be carefully measured to determine the maximum air space prior to breaking the block for the compressing tests, and the net compressive strength obtained shall then be reduced to compressive strength in lbs. per sq. in. of gross area, this being figured from the actual air space of the block determined above.

Absorption Tests—The sample is first thoroughly dried to a constant weight at not to exceed 212° F. and the weight carefully recorded. When dried, the sample is to be immersed in a pan or tray of water to a depth of 2 in., resting on two strips not over 1 in. in width to allow the water to have free access to face. At the end of 48 hrs. from the time it is placed in water, the samples shall be removed, the surface water wiped off, and the sample carefully weighed.

The German Evangelical Lutheran Trinity Church, Middle Village, Long Island, N. Y., Built of Concrete Blocks.

Practice in Manufacture for Concrete Architectural Stone, Building Blocks and Brick

Cement. The cement shall meet the requirements of the Standard Specifications for Portland cement of the American Society for Testing Materials.

Aggregates. The aggregates shall be clean, hard, durable materials, and shall have no coating of clay or other substances which would in any way interfere with the bond between the cement and the aggregate.

(a) Fine Aggregate. The fine aggregate shall consist of sand or crushed stone graded from fine to coarse, all of it passing when dry, a screen having ¼-in. diameter holes; not more than 6% of it passing a sieve having 100 meshes per lin. in.

(b) Coarse Aggregate. The coarse aggregate shall consist of gravel, crushed stone or other suitable material graded in size, which is retained on a screen havin ¼-in. diameter holes.

(c) Coloring Matter. Where color is required, only the most permanent and durable mineral colors shall be used and shall be considered as aggregate.

(d) Water. The water shall be clean, free from oil, acid, strong alkalies or vegetable matter.

The proportions of cement to aggregate shall be such as require at least the minimum amount of cement to produce strength and density as hereinafter specified. The proportions of the various sizes of aggregates and cement to aggregates shall preferably be made by weight. If by volume, a bag of Portland cement shall be considered 1 cu. ft.

(a) Measuring ingredients. Methods of measurement of the proportions of the various ingredients shall be used which will secure separate and uniform measurements of cement, fine aggregate, coarse aggregate, and water, at all times.

The ingredients of concrete shall be thoroughly mixed dry, sufficient water added to obtain the desired consistency, and the mixing shall continue until the cement is uniformly distributed and the mass is uniform in color and homogeneous.

(b) Relation of Cement and Aggregates. Concrete shall be mixed in the proportions of 1 part Portland cement to a total of not more than 6 parts of fine and coarse aggregates measured separately. In no case shall the proportion of fine aggregate used in the concrete mixture exceed three parts fine aggregate to one part cement.

Machine Mixing. The mixing shall preferably be done with a machine mixer of a type which insures the proper mixing of the materials throughout the mass.

Consistency—(a) Wet Process. The concrete must have at least a sufficient amount of water to make it so soft that it must be handled quickly to prevent it running off the shovel, but not so thin as to cause segregation of the materials.

(b) Semi-Wet Process. The material shall be mixed with a maximum amount of water permissible, and must have sufficient water so that the mixture will hold

Cement Block Wall at the Illinois State Reformatory, Pontiac, Ill.

its form after being compressed in the hand.

Retempering. Retempering or using mortar or concrete forty minutes after being mixed shall not be permitted.

All lintels, bearing stones and other members subjected to cross bending shall be reinforced by means of rods placed about 1½ in. from their tension surface, and the total sectional area for the reinforcement shall not be less than 0.8 of 1% of the cross sectional area of the concrete in the member reinforced. When any member exceeds in any dimension eight times its least dimension, it shall be reinforced to insure safety in handling.

Natural Curing. The concrete products shall be protected from the sun and strong currents of air for a period of at least 7 das. During this period they shall be sprinkled at such intervals as is necessary to prevent drying, and maintained at a temperature of not less than 50° F. Such other precautions shall be taken as to enable the hardening to take place under the most favorable conditions. Products must not be removed from the yard until they are 21 das. old.

Steam Curing. The products shall be removed from the molds as soon as conditions will permit and shall be placed in a steam-curing chamber containing an atmosphere of steam saturated with moisture for a period of at least 48 hrs. The curing chamber shall be maintained at a temperature between 100° and 130° F. The products shall then be removed and stored for at least 8 das. (This does not apply to high pressure steam curing.)

All surfaces and arrises of stone must be true and without imperfections.

All concrete products of full standard size shall be marked for purpose of identification, showing name of manufacturer of brand, date (day, month, and year) made.

All concrete products shall be handled with utmost care. When transported and subjected to rough handling they shall be crated and packed in non-standing material in such a way as to insure no damage from chipping or abrasion. All large and heavy stone shall be provided with hooks for lifting. When necessary stone shall be provided with metal bonds for the purpose of tying to the masonry backing.

FIREPROOF QUALITIES OF CONCRETE BLOCKS, INSURANCE RATES, ETC.

The insurance companies are undoubtedly severe in many instances in the hardships imposed upon the average block building, in the matter of rates, as compared with other materials, yet their ruling is based upon their experience with the action, under fire and water, of some block made of a dry mixture. Block are made so promiscuously and with such frequent evidence of lack of knowledge and skill, that the insurance companies attempt to protect themselves by their broad ruling. This may be unjust but it will probably not remain longer than the making of inferior material. I find that their attention directed to properly made, true, wet concrete units will secure for them the same rate consideration as is given brick buildings.

This, then, brings us to a consideration of how to make block of other than a dry mixture, with its attendant faults. Block should be and can be made as good as the best monolithic concrete. To do this, we use good, hard aggregate from, say ¾ in. down; good, clean, sharp sand and cement of such proportions as will approximately fill the voids, and water enough to produce a mix as close as possibly to quaky.

One other objection often named against block and which must be considered if we are to build large businesses in the manufacture of concrete block, is its inelasticity, in size. If manufacturers will adopt such a method of manufacture and such a system of construction as will furnish building units for all types of buildings in competition with all classes of other materials, taking it out of the "foundation only" class, they will secure for the block business the respect of architects and good builders, as well as a more reasonable consideration from the insurance companies.

In addition to being well made, block must have some qualifications of appearance. If a wet mixture is used it is practical to apply a facing made of cement and screenings of marble, granite, quartz, various colored sands, etc., producing effects equal to those of the handsomest stones. If properly handled, such material and such building units may be made at prices in competition with other materials now on the market.

I can make block of various pleasing faces that compete in price with brick of the cheap, common variety and on up to the highest priced brick and stone, and are acceptable by architects and builders in high class construction. With such material, there is no complaint of absorption, lack of strength or lack of fire resistance, because it is made of properly graded aggregate and enough water.—D. J. Stedman.

MORTAR JOINTS IN CONCRETE BLOCKS

Cracking of concrete block walls at mortar joints indicates a structural defect in either the foundation or the wall, which develops a crack in the weakest place; namely, the mortar joint.

In constructing a concrete block building, the bearing strength of the soil must first be ascertained and concrete footings of sufficient width must be designed to distribute the load over a proper bearing area. The foundation must then be accurately and firmly placed upon the footings so that there will be no possibility of the foundation failing in any part.

Assuming that the foundation has been substantially constructed, the most common causes of cracks developing in concrete block walls are expansion and contraction due to temperature changes in walls built without reinforcement, piers, pilasters or cross-partition bonding. Where such a wall exceeds 30 feet in length, it is desirable to guard against cracks by occasionally filling one or more of the hollow spaces (preferably beside a window or door opening) with 1:2½:4 concrete of quaky consistency. If the wall is subjected to unusual stress of any kind, ½-in. reinforcing rods may be introduced at the time of filling the hollow spaces with concrete. If a hollow space is filled in this manner on each side of a window, a reinforced concrete pier is created which gives remarkable stability to the wall.

Concrete block should invariably be laid in cement mortar, mixed in the proportion of 1 sack of Portland cement to 2 cu. ft. of clean sand. A small quantity of hydrated lime, not exceeding 10% of the weight of the cement, may be added for the purpose of making the mortar easier to work. Block should be thoroughly soaked with water before laying in the wall, in order to prevent them from absorbing water from the mortar. No mortar should be used after it has been wet more than 30 min. Mortar joints should be uniform and carefully filled. Nearly all manufacturers of block machines now furnish mortar plates or templates, which make it easier to secure uniform joints; ⅜" is probably the best thickness of mortar joint to adopt.

A DURABLE, PROPERLY MADE BLOCK CANNOT BE MARKETED FOR LESS THAN 12 TO 15 CENTS

That the concrete industry is in serious danger of being killed by the competition of cheap, worthless cement products, was declared at the opening session of the eleventh annual convention of the Mid-West Cement Users' Association. It opened March 1st at Hotel Rome, Omaha, for a three days' convention in connection with the Cement Show.

Honest makers of cement products, especially cement building blocks, were said to be "up against" competition by unscrupulous manufacturers, who are selling cement blocks at 9 cents, whereas a durable, properly made block cannot be marketed for less than 12 to 15 cents. The result is that ignorant buyers use the cheap product, and then blame concrete when their work goes to pieces in a short time.

C. A. Stevenson of Kansas City made this assertion, and was heartily seconded by Swan Larson of Omaha, Harry I. Purcell of Chicago, and other members of the association.

The outcome was that a committee was appointed, to suggest some plan for the adoption by legislation of standard specifications for the making of cement products, so that only good products can be lawfully used and worthless cement products will become a thing of the past. This committee consists of W. A. Collings of Kansas City, Mr. Larson and Mr. Purcell.

CONCRETE BLOCKS FACED WITH WHITE CEMENT

Block manufacturers should learn of the exceedingly beautiful finishes that can be secured with Medusa White Portland cement when used with white sand, ground white marble, quartz, white limestone, etc. When they realize that they can produce blocks that have the appearance of marble, at only small additional cost over gray Portland cement blocks, with a wonderful increase in the demand for their product, by the use of Medusa White, they will quickly adopt this material for all their future work. By the use of Medusa Waterproofed White cement, concrete blocks can be made impervious to water and dampness, and the last objection to this form of construction is removed. Block makers using Medusa Waterproofed White will have the advantage over their competitors who do not use this material and who cannot guarantee waterproof work, and the cost is insignificant, as it is only necesary to use the Waterproofed White cement in facing of blocks. The Sandusky Cement Company, T-1 Engineers Bldg., Cleveland, O., will gladly furnish, free of cost, any of our readers a copy of an interesting booklet, entitled "The Medusa White House."

MOLINE CAST STONE COMPANY

The Moline Cast Stone Company, successors to Wells & Larson Cement Products Company of Moline, Ill., expect to begin operations about May 15th in their new plant, which covers 4,800 sq. ft. of floor space. The new plant is located on their own ground of 1½ acres which they recently purchased. The company is an old established one and for many years have been manufacturing concrete blocks and recently they discarded all their old equipment and have adopted the Zagelmeyer system of poured concrete building units, which they declare is the only sure way of turning out a better product that will give absolute, permanent satisfaction and stand the test of time.

Plant of the Sac City Cement Pipe Company

Capacity Six Carloads of Drain Tile a day. They use as much and often more than three hundred barrels of cement a week.

When a cement tile manufacturer looks ahead to a larger business than the local trade on drain tile and builds up his factory to meet the requirements of equipment and economy of manufacture necesary for the successful fulfillment of public ditch contracts, he finds a heavy investment and an extensive plant essential. Economical location in a suitable territory for the use of tile,—economical with respect to all items of cost if possible, such as raw materials, labor, power, shipping facilities,—is not often easily found. Much might be learned were the manufacturers to visit a factory where the advantages of an unusually good location have been seen and improved, and we know of no better example than at Sac City, Iowa.

The Sac City Cement Pipe Company operates a double plant at the city named. The Sac City plant has a nominal capacity of six carloads of drain tile a day and uses as much and often more than three hundred barrels of Portland cement a week. Situated so as to have a twenty-acre sand bank at its very doors, claimed to be of extra quality for tile making, with two railroads over which its products can be shipped, with water power and good labor supply, it has almost every advantage. The following details will be of interest.

The large plant is 100x140 feet outside dimensions. In this building is a National Automatic cement tile machine with Elite continuous mixer and sand conveyor. The smaller building is 36x50 feet, with five rooms in addition, 8x60 feet each. In this building is a tile machine for making the sizes of tile 5 inches up to 18 inches diameter, and either 12 inches or 18 inches long, as desired, a Jaeger mixer, sand elevator, and seventy cars. Each of the five curing rooms have two tracks and each track holds seven cars.

The output of this factory is cured by steam and all tile are watered four to five times each day, so that the strength of the cement is developed properly. The size of the larger building indicates the attention the builders gave to the subject of curing.

All the machinery is connected to the water power furnished by the river, so that except in low stages of water the cost of this item is very small. To run the plant when the water power is not available direct connection is made to the city electric plant. It will thus be seen that the machinery could well be operated on the direct-connected unit system—each machine connected to a separate motor. This system avoids stoppage of all machinery when one machine breaks down and gives the plant designer an opportunity to place his machine wherever desired.

The sand is handled but once—from the pit to a belt conveyor. The conveyor carries the sand to an elevator at the top of which is a revolving screen. The screened sand drops into a storage bin, underneath which is a track and a dump car having a capacity of one cubic yard. By pulling a slide the car is filled with sand and then hauled by a horse to a pit about 3 feet deep by 8 feet long, into which the sand is dumped. Here an augur pushes the sand into a 12-inch conveyor which takes the material to a hopper over the mixer. At this pit there is also an augur and chain and bucket elevator, which is used for loading cars for a factory at Jolly, Iowa.

The buildings are heated by a Murray boiler and steam coils. In cold weather all the sand used is heated before being made into concrete, and hot water is piped to the mixer so that no frosty materials are ever made into tile.

This company is now furnishing tile for Calhoun County Drain No. 163, Pocahontas-Calhoun County Drain No. 47-79, Sac-Bena Vista-Calhoun County Drain No. 16-30-92, improvements of the value of $83,000. In order to secure county ditch work today, the very best quality of tile must be guaranteed and the Sac City Cement Pipe Company has secured its contracts on that basis. As evidence, one of their tile haulers turned in eighteen freight bills of shipments to Calhoun Drain No. 163 with the report that there was only one tile broken in shipping and hauling. Nineteen tile were broken out of sixty cars, twelve of which were caused by inexperienced handling when unloading the cars. When we can all make cement tile of such quality, there will be no question as to the superiority of cement tile. Many factories are making tile of unquestionable quality, and cement tile are coming to the front all over the country, but none more successful than the record stated.

The Tile Yard Plant of Cement Products Co., Sac City, Iowa. Their gravel pit is shown in background. Material at the pit is deposited in hopper over conveying belt and sand is conveyed to the screens and then to the concrete factory.

It pays to establish a record for the highest quality of goods. Poor materials cannot be made into good tile, nor can good materials be made into good tile unless the manufacturer understands his business and is equipped to make them properly. It does one good to find manufacturers proud of their record, never satisfied with less than the best, confident enough to place an absolute guarantee behind their tile for both strength and durability. Where this is the case, prejudice toward a new article disappears and the goods advertise themselves. Mr. J. J. Hammen, the genial director of the Sac City plant, deserves praise for the enterprising manner which has made his plant a success, and more for the practices in operation in his plant which have won the confidence of the users of his tile.

CEMENT AND ENGINEERING NEWS

(PUBLISHED MONTHLY)

WILLIAM SEAFERT, Editor and Publisher

Office—672 Transportation Building, Chicago

Telephone, Harrison 5397 Cable Address, "Seaferts" Chicago

Entered at the Post Office at Chicago, as second-class matter, July 21, 1896 under Act of March 3, 1879

SUBSCRIPTION RATES:

United States, Canada, Philippine Islands and Mexico, two years for $1.00; all other countries, $1.00 per year.

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Advertising copy or changes in ads. must be in this office by the 25th of each month, as hereafter our magazine will appear on the 5th of the following month

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JOHN F. WALDRON - - - - - - - - Advertising Manager

CHICAGO, MAY, 1916

DYNAMITE AS A LABOR SUBSTITUTE

Necessity forces the adoption of new methods. And no need is so pressing as the need of men to do the world's work when the supply is short. That condition exists today and will grow progressively worse.

Not alone do war conditions demand enormous levies of the male population of belligerent countries for service at the front. A peace army of mechanics and laborers, almost as great as the fighting unit, is also required to run each nation's machinery and maintain its home operations.

A large proportion of the manufacturing plants of this country in many lines are working on commodities for the warring nations—not only military equipment but goods of all kinds which the belligerents are unable to make owing to the scarcity of labor.

The resulting exceptional demand for men in this country has been augmented by the exporting of many skilled mechanics to England. Our farms, being worked to the last square foot of soil to supply the world's need for food, will be seriously handicapped this fall for harvest hands. All of which points to the immediate need of substitutes for labor, writes the Du Pont Powder Company of Wilmington, Delaware.

Farmers generally are adopting two substitutes: tractors and Red Cross Dynamite. It is stated that Henry Ford is about to turn out a tractor to sell for $200.00 at the rate of a million a year.

Last year farmers bought approximately 25,000,000 pounds of dynamite, and their purchases increase yearly. In what other lines can Red Cross Dynamite serve as a practical substitute for labor?

Here are a few:

Excavating cellars, ponds and reservoirs. Cleaning the mud out of old ponds and streams. Loosening old road beds for grading with horse shovels or steam shovels. Blasting holes for telegraph and telephone lines and fence posts. Straightening streams by blasting new channels. Wrecking old buildings, bridge piers and stone walls. Scrapping boilers, machinery, steel buildings and bridges. Blowing down clay in brick yards. Breaking up frozen ore on ground or in open cars. Loosening ground for sewer excavations, thereby saving half the labor. This can be done without danger to the public or to underground pipes. Ask us how.

These are but a few of the more common classes of work that can be done with Red Cross Dynamite cheaper and quicker than by labor alone.

Let every civil, railroad or municipal engineer, or contractor who is worried over the labor problem consider what parts of the work can be done with Red Cross Dynamite. If in doubt, ask us.

CEMENT PRICES MAY ADVANCE

Contractors from Michigan who attended the cement show, held at Chicago, say that while no further advance in the price of cement was announced at the convention, present indications point strongly to the market soaring again in the near future. Cement manufacturers show no disposition to urge prospective customers to book orders for future delivery. They are making no effort whatever to stimulate business at the present prices of their products, evidently anticipating a rise within a short time. The expected advance in the price of cement is merely a result of the expansion and development of building operations all over the country, and it resolves itself down to the question of supply and demand, says the "Michigan Manufacturer."

As for the general conditions prevailing in the cement industry, the present situation and the outlook are better by far than at any time for many years. Because of the unusually brisk demand for the product and of the higher price it commands, a more harmonious spirit exists now among the manufacturers than ever before, and the generally optimistic feeling has had the effect of drawing them closer together in their trade relations.

CONCRETE DWELLING HOUSES

A housing scheme has been carried out at Renfrew, Scotland, which is particularly interesting from the fact that the houses have been built of concrete. The architect is an enthusiastic believer in concrete for houses, holding that it is the solution of the cheap housing problem, though he thinks the best method of building with it has yet to be devised. He estimates that he effects a saving of £12 ($60) on a pair of cottages, and where large numbers are built together the saving is still greater.

The Renfrew houses, according to a London paper, are conveniently planned, and of attractive appearance. The walls are 9 inches thick, including a 2 inch air space. The longitudinal partitions are formed of coke breeze concrete slabs, and the cross partitions are brick. The external walls are rough casted with Portland cement and granite chips.

UNFAIR SPECIFICATIONS INCREASE COST

"The business relations between the contractor and the engineer are little understood by the public at large. We frequently hear a contractor on public work condemned for failure in bridges, roads or pavements when he was entirely innocent, having built the work in strict accordance with specifications furnished. Yet the general public makes him the 'goat' and the engineer, who has prepared faulty specifications, goes out free. Of course, the engineer may take the position that if the contractor does not like his specifications, he need not bid on the work, but this is not only unfair to the contractor but also to the owner, because it reduces competition by eliminating intelligent and responsible contractors.

Concrete Highways

BY GEORGE W. MYERS, COLUMBUS, OHIO.

The most durable and economical type of highway ever devised. Concrete roads are passable at all seasons of the year, always free from mud and dust.

It is my purpose on this occasion to present certain observations based upon recently acquired personal experience in the construction of concrete roads.

That modern traffic demands better and heavier types of construction than have been used in the past is universally conceded. In brief, it is quite as essential to adopt permanent improvements of this character for public highways as for railways. Undoubtedly the consensus of opinion in engineering circles is that the waterbound macadam and gravel roads are obsolete, a conclusion based upon practical experience with these types of roads, it having been demonstrated that they cannot withstand fast-moving automobile traffic, which will represent the preponderance of traffic in the future, if it has not already reached that status. The slipping and grinding action of the driving wheels of the automobile loosens the binding dust, which is subsequently dispersed by winds and rain, to be followed by the rapid disintegration of the road. It is imperative that we find a remedy for this condition, and my recent experience in the construction of concrete roads has led to the firm conviction that highways of this type, when properly constructed in one or two courses, will solve the problem. This conclusion is based upon the reasonable first cost and extremely low maintenance cost of concrete roads, as well as their general efficiency under every type of traffic.

Naturally, the query arises: "Why is there true economy in first class concrete roads?" This may be answered in part by stating that official and entirely reliable records show that the average cost of building a one-course concrete road is $1.24 per square yard, and for a two-course concrete road $1.40 per square yard, and that maintenance, which is just as important, if not more important, than initial cost, is from ¼ to ½ cent per square yard per year. This is the record in spite of the tremendous increase in traffic brought about by improved roads, the figures covering actual cost on roads throughout the United States. From a carefully compiled table of comparative cost data on concrete and macadam roads, the accompanying table has been prepared.

Comparative Cost Data on Concrete and Macadam Roads.

First Cost.	Concrete Roads. 500 miles to be built during 5 years. 100 miles per year at $13,000 per mile. $1,300,000 per year.		Macadam Roads. 500 miles to be built during 5 years. 100 miles per year at $10,000 per mile. $1,000,000 per year.	
Accruing costs first year	Interest including extinguishment 4.47%	$58,110	Interest including extinguishment 4.47%	$44,700
	No maintenance.		No maintenance.	
Second year	Interest	116,220	Interest	89,400
Third year	Interest $174,330		Interest $134,100	
	Maintenace 2,500	176,830	Maintenance 100,000	234,100
Fourth year	Interest 232,440		Interest 178,800	
	Maintenance 5,000	237,440	Maintenance 200,000	378,800
Fifth year	Interest 290,550		Interest 223,500	
	Maintenance 7,500	298,050	Maintenance 300,000	523,500
Sixth year	Interest 290,550		Interest 223,500	
	Maintenance 10,000	300,550	Maintenance 400,000	623,500
Seventh year	Interest 290,550		Interest 223,500	
	Maintenance 12,500	303,050	Maintenance 500,000	723,500
Eight to 20 years	Interest for 13 years $3,777,150		Interest for 13 years $2,905,500	
	Maintenance for 13 years 162,500	3,939,650	Maintenance for 13 years 6,5000	9,405,500
	Total	$5,429,900	Total	$12,023,000
	Total cost per year	271,495	Total cost per year	501,150
	Cost per mile per year	542.99	Cost per mile per year	1,202.30

Note.—The concluding figures giving the cost per mile per year of the representative types of roads include both interest and maintenance. There is a vast difference, however, when maintenance costs alone are considered. By referring to the seventh year it will be seen that the maintenance charge for concrete is only $12,500 as against $500,000 for macadam.

To show that the comparative figures given in the table have not been strained in favor of concrete roads

it may be stated that in estimating the maintenace charge for macadam roads, an average of the cost in the states of New York, Pennsylvania and New Jersey was taken. For the concrete road the average cost of maintenance on a Bellefontaine, Ohio, road was taken for a period of 18 years. The interest charges include extinguishment fund on bonds maturing in 50 years, although the table is carried only to the 20-year point.

As a further example I recall a street intersection laid more than 11 years ago by City Engineer Fred R. Charles, of Richmond, Ind., which is still in very serviceable condition and has cost little or nothing for maintenance. In later work both methods and designs have been improved and without doubt the 15 or 18 millions of square yards to be finished this season in the United States and Canada will give excellent returns on the investment.

Before taking up the concrete features of road construction it is important to consider the foundation. The shape of the sub-grade has received a great deal of attention of late and the present prevailing practice is to make it practically flat, with a recommended tendency toward a "dished" or concave surface, theresile stresses are greatest. The compacting and drainage of the sub-grade are of the utmost importance in a concrete road as well as in any other type of road. The rolling should be done thoroughly with a roller sufficiently heavy to compact the materials to a depth of 6 or 8 inches. The weight of the roller and number of times the road should be rolled depend upon the material, bearing in mind the fact that better results can be obtained by using a lighter roller many times than by using a heavy roller only once or twice. It is also important to have the sub-base free from ruts and depressions, and in a saturated condition before placing the concrete upon it.

If the sub-soil is not self-draining in nature, subdrains should be installed. These should be of broken stone, gravel or farm drain tile placed on one or, in extreme cases, both sides of the roadway, with transverse lines about every 50 feet, and from 2 to 3 feet deep, with good and sufficient outlet. As a government engineer has said: "The first consideration is drainage, the second consideration is drainage, and the third consideration is drainage." In other words, the matter of proper drainage cannot be too strongly emphasized.

In constructing a concrete road over an old macadam road, especially where the new road is to be wider than the old road, it is considered the best practice to first scarify, spread and roll the old roadbed. This is to insure a sub-base of an even bearing quality. Disastrous results have followed neglect of this important matter.

Upon this properly prepared sub-base is laid the concrete road, and here again no set rule can be given as to the proper shape and thickness of the road, but it has been found that a crown 1/100 of the width of the pavement is ample to care for drainage and except in extreme cases, should not be exceeded, as the low crown tends to keep traffic well distributed, thus making it a decided asset to any road. On country highways we specify a minimum thickness of 6 inches at the sides of the road, but this does not mean that on a well prepared sub-grade the road must be 6 inches thick to withstand the ordinary automobile traffic of rural districts. It allows a factor of safety to care for weaknesses in the preparation of the sub-grade and for the contractor who often believes a 6-inch thickness means about 6 inches and then interprets it to 4½ or 5 inches.

The proper selection of materials is a subject to which considerable time could be devoted if at our disposal, as the quality of the aggregates is of utmost importance. The durability of the road depends upon the character of the concrete and this depends upon first the materials and then the workmanship. A few simple rules covering the most essential requirements for sand and stone are as follows:

First. The fine aggregate should be actually tested for mechanical analysis and tensile strength in mortar, because even the most experienced cannot always distinguish the appearance between good and poor sand.

Second. Use a coarse sand, free from fine particles; or screenings from hard durable gravel, granite, trap or other hard rock, with dust removed. An excess of fine material not only weakens the concrete, but will also form on the surface a layer of weak mortar having no wearing quality. Furthermore, it will retard the set, which is especially objectionable in cold weather. Even though the briquette test be high with a sand having a considerable proportion of fine particles, the mortar may not have good resistance to attrition or wear.

Third. The fine aggregate must be clean and should contain not over 3 per cent by weight of finely divided clay, loam or other suspended matter. If it is not free from vegetable or organic matter it is liable to harden not at all or too slowly to be serviceable.

Fourth. An ideal sand would be one fulfilling the above conditions and composed of rough grains—to which the cement paste will adhere more rapidly—well graded from fine to coarse and not having more than 33 per cent of voids.

The coarse aggregate should be a hard stone, such as granite, trap, gravel or hard limestone. This is necessary to resist the wear and abrasion of hoofs and wheels. A very satisfactory stone is the crushed granites of New England or the hard limestone occurring in certain localities along the Hudson River and sold in New York as trap rock. A hard limestone cannot be cut with a knife and its specific gravity is high, say over 2.70. Although gravel does not bend quite as readily as broken stone, nevertheless, with proper care, it makes a good surface.

Naturally mixed aggregates or "run of bank" gravel, no matter how tempting, should not be used unless they are washed and screened on account of the irregularity of practically every bank and the excess and varying amount of sand.

For communities where good material is not available at the average cost there has been designed the two-course type of construction consisting of a 4- to 6-inch foundation course of the inferior local materials and a 2-inch top or wearing course of materials especially adapted to this use. This provides for the construction of a serviceable and durable road nearly as cheaply as one-course roads constructed in localities wherein good materials abound.

I have said that the success of a road depends first upon materials and second upon workmanship, and by workmanship I mean the proper method of construction and the proper supervision, which will insist upon a strict observance of specifications or the carrying out of the methods described. The first question which arises in this connection is: In what proportion shall materials be mixed? The average engineer immediately recalls his favorite formula and puts in his specifications 1:2:4 or 1:2½:5 or whatever it may be. Now I wish to emphasize the fact that this should not be a hit-or-miss proposition. Concrete roads must stand not only tensile and compressive stresses, but wearing and abrasion, and to properly withstand these they

should be built of the densest concrete possible without too great an excess of the matrix. In order to determine this the aggregates should be tested for the percentage of voids. It is needless to say that only a batch mixer can be used and each mix should be revolved a sufficient number of times to thoroughly coat the particles of stone with the matrix. Concrete mixed with an excess of water is easier to mix, to handle, to place and to finish than concrete of the proper consistency, and for these reasons there is a decided tendency to mix it too wet. This is a serious defect as it causes a separation of the coarse material from the mortar, resulting in stony pockets. It also allows the excess water to run over the side forms, carrying with it cement, and the water which does not run over, collects in and hides depressions and inequalities in the surface, which cannot be detected until the water has evaporated. Furthermore, an excess of water will retard the setting of the concrete to the extent that it will not have sufficient tensile strength to counteract the shrinkage brought about by the subsequent rapid evaporation. The concrete should be placed as rapidly as possible in successive batches and spread to approximately the desired thickness in a continuous operation between transverse joints.

These joints are open to considerable criticism, much of which is warranted on account of lax methods employed in constructing them, but nevertheless until we can make a concrete not subject to changes in temperature and moisture we must allow for the contraction and expansion which takes place, and experience has demonstrated that unless provision is made for this change a road will crack about every 30 feet. Therefore, a joint is essential and the type of joint to be used depends upon whether or not the road is to be maintained, or rather, whether a proper system of road maintenance is in vogue. If it is, the joint which has met with greatest success is one composed of a layer of bituminous felt, which is allowed to extend slightly above the surface of the road, and which afterwards is hammered down upon the rounded edges of the concrete, thus protecting them from wear. This protection must be renewed from time to time by the application of a hot bituminous mixture. Where maintenance cannot be counted upon it is necessary to permanently care for these edges with soft steel protecting plates, which are placed each side of the "filler" by means of an installing device supplied by the manufacturers of the plates. Neither type of joint is difficult to make, simply requiring the exercise of the care and precaution so often lacking in modern highway construction.

The road is finished or given its crown by means of a template or screed cut to the finished surface of the pavement and operated with a combined longitudinal and crosswise motion. Two or more applications are necessary to secure the proper results. After the water has disappeared from the surface all slight irregularities are removed by means of wooden floats. The best working size is about 6 x 16 inches and the work of finishing must be done from a bridge spanning the concrete.

A feature often neglected in concrete work is the matter of curing and in road work this is a very important detail. Concrete must not be allowed to dry too rapidly, and consequently plenty of water should be sprinkled upon the road directly after hardening. In order to keep the surface wet and to obviate the necessity of continual sprinkling, a layer of at least two inches of earth or sand should be spread upon the surface as soon as the concrete is sufficiently hard not to be disfigured by this treatment. It should be kept wet for at least ten days, and, if possible, traffic should not be allowed on the road for an additional period of ten days.

We frequently hear it said "when in doubt reinforce the pavement." This is usually essential in a pavement 20 feet or more in width and serves as a factor of safety in any pavement. The reinforcement that has given the best results in this kind of work is a mesh composed of small wires, which, as a general rule, should be placed about 2 inches from the surface.

In conclusion, there is a phase of the concrete road proposition which we are bound to consider without regard to any theoretical or professional view we may entertain. It is the extremely important fact that many miles of this type of highways have been tested under practical conditions for periods ranging from 5 to 20 years and that they have proved to be entirely efficient. The present situation as to concrete roads recalls the wide-spread discussion that took place some years ago concerning the fire-resisting properties of concrete. It was the consensus of opinion, after many laboratory tests had been made, that concrete would crack, spall and crumble under stress of fire. It remained for Professor Ira H. Woolson, then of Columbia University, to demonstrate the utter fallacy of our theories by making tests upon large specimens subjected to practical conditions, and it was found that concrete, especially cinder concrete, was the very best of modern fireproofing materials. We daily encounter grave discussion concerning cracks in concrete roads, but fail to realize that there is a vast multiplication of these cracks in every brick road, the mere regularity of pattern disguising that which becomes conspicuous in the concrete road. We fill the cracks between the bricks with a cement grout and the cracks in cement with tar and sand. Concrete joints occur every thirty feet, brick joints every three inches. Thus we must not lean so far backward in our professional pride as to ignore the practical and common sense conclusions to which the tax-payers and users of these roads have come, namely, that they are the most durable and economical type of highway ever devised; that they are better fitted for horse and motor traffic than any other type of road; that they are passable at all seasons of the year, always free from mud and dust, never slippery and that they compare favorably in low construction cost with the best type of waterbound macadam roads.

MANUFACTURE OF SAND-LIME BRICK ON THE INCREASE

The report on sand-lime brick soon to be issued by the Geological Survey will show that sales of this product in 1915 were 179,643,000 brick, valued at $1,135,104, which was an increase of 7,014,000 brick or 4 per cent in quantity and of $76,592 or 7 per cent in value over 1914. Michigan was the leading State, reporting sand-lime brick marketed to the value of $286,948 or over one-fourth of the quantity and value of the sand-lime brick sold in the United States. Minnesota was second and New York third. The sand-lime brick industry, after experiencing the ups and downs of a new industry, the report states, has become firmly established and has found "its place in the sun." Many operators are reported as enlarging the capacity of their plants in anticipation of increased business during 1916.

LIME COMPANIES MERGE

The Kelley Island Lime & Transport Co., Cleveland, Ohio, it is announced, has purchased all the holdings of the Ohio & Western Lime Co., including plants at Genoa, Gibsonburg, Luckey, Tiffin, Fostoria and Marion, Ohio, and Huntington, Ind., and adding 147 kilns and numerous quarries to its property.

SELF-PROPELLING WAGON LOADER

The illustration below is a Jeffrey Type A-15 Self-Propelling Truck Loader with special two-way screen chute in a gravel pit at Canton, Ohio. By changing the removable screen, different size products may be obtained. This loader is proving very satisfactory and will soon pay for itself owing to the reduced cost of loading and screening sand and gravel. By the use of the Special Two-way screen chute two wagons may be loaded at one time.

Mr. Lyman Huntley of Syracuse, N. Y., wrote the manufacturers of this loader under date of February 24th, 1915, as follows:

"The Jeffrey Loader which I bought from your company a short time ago is giving good service. We have used it for loading sand at our bed and find that we can load and screen about a yard a minute, with the assistance of one man. We are perfectly satisfied with the machine and are pleased to recommend the same."

The Jeffrey Self-Propelling Loader will easily handle from 1 to 1½ cubic yards of crushed stone, sand, gravel, etc., per minute, and is guaranteed to handle crushed stone up to 3½" ring. The Self-Propelling Device enables it to be moved from pile to pile under its own power—and only one man is required to operate it.

A-15 Loader with Special Two-Way Screen Chute. By changing the removable screen, different size products may be obtained.

The Collapsible Elevator makes it available about all parts of the yard—makes it easier to operate over rough ground—permits it to be used where low doors, trestles and other overhead obstructions are encountered.

This loader is manufactured by the Jeffrey Mfg. Co., 914 North Fourth Street, Columbus, O. Write for Bulletin No. 165-14 containing specifications, prices and full details of their standard loaders to suit various conditions and materials.

NEW SAND COMPANY IN HUTCHINSON, KANSAS

J. H. Shears & Sons, sand and gravel producers, Hutchinson, Kans., are installing a Kiesler clam shell outfit along the Arkansas river.

The plant is to consist of an electric hoist, driven by a 25 horsepower Westinghouse electric motor. At the present time a steam hoisting engine and drum is being used. A sixty-foot tower has been erected on the north bank of the river, a steel cable extending south across the river to the south bank. On this cable a pulley runs, supporting a bucket, which is operated by the man in charge of the hoist. By pulling a rope, he snaps the trigger and unloads the bucket wherever desired, the sand being dropped into a wagon or into the storage tank.

The bucket, which is a big steel affair, having a capacity of picking up a cubic yard of sand and loading and unloading at the rate of a yard a minute, drops down into the river hard enough to sink into the soft sand and the upward motion causes it to pull together, the parts closing similar to the action of a pair of pincers. The loaded bucket is pulled back over the bank and the sand released, the bucket starting back to the river again, empty.

The plant has a big storage vat, with a capacity of 600 yards, which is about the capacity of the plant for a good day. Out of this cars and wagons can be loaded automatically. A switch track is to be extended to the storage tank.

C. E. Brown, sand dealer, Hutchinson, Kansas, is building a new sand boat, which will soon be in operation. The Erie centrifugal pump is to be operated by a Westinghouse electric motor, the sand being thrown out on the shore along with water, the water being allowed to drain back into the stream.

The Beebe Sand Company of Hutchinson, which has a big steam pump on a flatboat, are enjoying a large business just now.

NEW WATERPROOFING BOOKLET

A new and attractive Medusa Waterproofing booklet has just been issued by the Sandusky Cement Company, T-1 Engineers Bldg., Cleveland Ohio. This booklet covers the use of both Medusa Waterproofing powder and paste, with complete directions for use, and also a large number of illustrations showing a variety of work where these products had been used, together with letters from engineers and contractors who have used it with great success. The booklet will be sent free by the company to any one who is interested, by mentioning Cement and Engineering News when writing.

SAND AND GRAVEL PLANT OPERATED BY OIL ENGINE.

Recent installation at the crushing and sizing plant of Vashon Sand & Gravel Company, Seattle, is of some interest by reason of fuel oil costs developed there. We refer to a 25-H. P. semi-Deisel type of oil engine, which operates a gyratory crusher. In this machine special low-grade fuel oil is used which costs in Seattle 95 cents per barrel of 42 gallons; and the plant operates at a fuel cost of 75 cents per 10 hours.

The crusher is run on boulders six to eight inches diameter, which are reduced to about one and a half inch size. The material, including sand, gravel and boulders, is washed down from a hillside, situated about 300 feet above tide level. The hydraulic work is carried on by means of a pumping plant and a pipeline, plying a stream of water against a face 200 to 250 feet high, washing the material down to a flume by which it is conveyed to grizzlies and crusher. All material passes over a 1½-inch grizzly, the under size being carried on to the sizing screens; the oversize passes through the crusher, and thence to the screens. In like manner all crushed and classified material passes by gravity to the loading bunkers.

As a means of close speed regulation the crank of the oil engine receives an impulse at every revolution, the sensitive governor gauging the fuel to meet any change in load. The momentum of the heavy flywheels equalizes the forces to maintain a constant speed, making the engine specially adapted to any machinery requiring a constant, steady force.

Tube Mill Pebbles and Substitutes

For Grinding in the manufacture of cement in the United States.

In this country, grinding by pebble mills is practiced chiefly in the manufacture of cement, in the metallurgy of gold and silver ores, and in the grinding of feldspar and quartz and of certain mineral pigments. These industries have grown to be in a large measure dependent on this method of pulverizing, so that after August 1, 1914, when conditions in Europe threatened to make it difficult to obtain an ample supply of flint pebbles and when there were sharp advances in price quotations on pebbles, efforts were made to find a domestic supply of similar pebbles and to find and test domestic substitutes for flint pebbles. On account of the large quantity of foreign flint available and the low prices at which it had been offered, there had been little such effort prior to 1914 on the part of geologists, dealers, or users of flint pebbles. And yet some work along this line had been done. Pebbles of granite, quartzite, and other material have long been imported from Newfoundland and Ontario. Some cement plants had successfully used local stream and beach pebbles. Late in 1913 Mr. Omar Maras, of Nevada, began the experimental manufacture of substitute pebbles, which has since met with considerable success.

Sources of domestic flint pebbles are probably still only partly known. The principal localities in which they have been noted in particular abundance are all in the Gulf states. It may be stated that, in general, flint pebbles in that region are to be found in that part of the coastal plain which borders the southern Appalachian and Ozark mountain regions. Flint pebbles are to be looked for in this coastal plain region along stream terraces and bottoms. The pebbles are for the most part small, few exceeding 2½ inches in diameter, and it does not seem probable that they will meet the requirements of mill practice, particularly because satisfactory pebbles can be obtained elsewhere. Another possible source of American pebbles which is worthy of investigation is the area of flint-bearing cretaceous limestone, particularly the formation named the Edwards limestone in the United States Geological Survey publications on central Texas. Other kinds of tough, siliceous, and not unfamiliar pebbles found in abundance in some parts of the United States consist of agate, carnelian, and petrified wood. Stream bottoms or shore deposits containing them should be searched. At present there is no satisfactory information as to the availability of these materials for pebbles for grinding.

The above-mentioned material has given no promise of successful substitution of domestic material for foreign flints, but the success in recent experiments on the substitution of other materials seems to be a herald of American independence. For example, selected, well-rounded quartz pebbles from stream gravels in Amador County, Cal., have been satisfactorily substituted for Danish pebbles in a gold mill. One of the large California rock-dressing plants which handles dredge tailings in the gold placer fields is sorting pebbles suitable for this use. A cement mill on the Pacific coast is making large use of pebbles which are found in great quantities along the shore. It is reported that in fineness and quantity of output the results of the use of these pebbles are as good as results obtained with foreign pebbles. Other California cement mills have used local pebbles at times during the last ten years, but no specific records of the results are to be had. Pebbles from the north shore of Lake Superior and from Conception Bay, Newfoundland, which are largely quartzite and granite, have been supplied to cement grinders for many years. There are within the borders of the United States numerous deposits of gravel containing pebbles as good as these Canadian pebbles. Suitable rhyolite and basalt pebbles can be found in the Rocky mountains and in the Pacific states. Granite pebbles are abundant on the flanks of the Sierra Nevada in proximity to many gold mills. In the eastern United States rhyolite and felsite are abundant on the eastern coast from Marblehead, Mass., to Eastport, Me. As to the quantity available, it is impossible to make definite statement, but it may confidently be ventured that thousands of tons may be gathered in favorable localities along the shores of Maine and of Lake Superior.

The artificial preparation of pebbles for grinding has, locally at least, been successful. Tube mills were first supplied with cast-iron balls for grinding. As these were not satisfactory for all purposes, flint pebbles supplanted them. Porcelain balls had been used, but they are not so hard and efficient as flint. The manufacture of pebbles or balls from natural rock has been tried at Manhattan, Nev. At that place the dense and banded but originally homogeneous rhyolite, which has been silicified so that it is now spoken of as onyx, is used. The rock is broken into blocks of suitable size and then rounded off by tumbling a charge of blocks in a revolving chamber. The roughly rounded pebbles so made have been tested in several of the large Tonopah metallurgical mills and have been found to be quite as efficient as Danish flint pebbles. Another substitute for flint pebbles has been found in the use of chunks of flinty ore. Satisfactory data are not at hand to judge of the success of this practice, but at any rate, further experiment along the line of using chunks of the substance to be ground instead of pebbles should be made before the method is discredited.

Angular blocks of basalt lava have been used in two instances known to the Survey. At a gold mine in eastern Oregon a dike of tough mineralized trap rock encountered in mining supplied blocks which were substituted for flint pebbles in the tube mill. Results of this practice seemed to be satisfactory as a matter of economical grinding, and at the same time there was a recovery of the mineral in the trap rock. The other example of the use of basalt gravel is from the cement mill of the United States Reclamation Service at the Arrowrock dam. The angular blocks of basalt rock collected along the line of the Arrowrock railroad have been used with entire satisfaction. It is found that the corners and edges of the basalt rocks ground off quickly and the chunks were reduced to spherical or ellipsoidal forms. According to the superintendent of the mill, these pebbles wear longer than Danish pebbles, and he believes that they are actually more effective.

From the foregoing outline it is concluded that pebble-mill grinding in the United States need not suffer because of conditions in Europe.

HYDRAULIC CEMENT IS BY-PRODUCT OF POTASH PLANT

After about eight years' experimental work, subsequently followed by several months operation in a practical demonstrating plant at Catasauqua, Pa., where a large cupola was available, it is now proposed to enter the commercial field with the Brown process for the production of hydraulic cement as a by-product in the manufacture of potassium salts from feldspar and limestone. A 20-ton-per-day potassium salt plant is being constructed at Buffalo, N. Y., by the Buffalo Potash & Cement Corporation, 49 Wall street, New York, N. Y., which will produce daily 1,000 bbl. of cement. The process is covered by several United States and foreign patents, three patents being issued in 1915.

The methods employed are to use crushed limestone and feldspar, or other potassium silicate rocks in such proportions that the resultant fused mass will carry approximately 50 per cent of lime. The materials are placed in the furnace without drying or grinding and are thoroughly fused and maintained at a temperature of 1300 deg. C., at which temperature the potassium salts are volatilized and carried along with the furnace gases. These gases are used for raising steam in the waste-heat boilers, which steam furnishes all the power required for the operation of the plant. After the gases are cooled down sufficiently, i. e., to about 400 deg. Fahr., the entrained potassium salts are collected in cyclone collectors, or Cottrell apparatus, and the last traces of the potassium salts are sent through wet washers, thereby saving practically all of the volatilized potassium salts.

After the potassium salts are volatilized, the modern material issues from the furnace in a stream which is similar in appearance to molten slag, but has properties widely different from the slag of a blast furnace. This material is granulated and treated with salt solutions of such a nature that when it has been granulated and become cold it bears a striking similarity to Portland cement clinker. When the clinkers are ground and mixed with a small percentage of gypsum, or other materials for regulating the set, the cement is ready for use.

The technical investigation and experimental work were done under the direction of H. E. Brown, consulting engineer, of New York City, to whom the patents were issued.

NEW CEMENT MILL FOR CUBA

Mr. Ellis Soper of the Soper Engineering Co. of Chattanooga, Tenn., Construction Engineer on the Market Street Bridge, Chattanooga, has been appointed Chief Engineer of Design and Construction of the plant of the Cuban Portland Cement Co., Havana, Cuba. Sheldon H. Bassett, former president of the Iola Portland Cement Company and now president of the Knickerbocker Portland Cement Company will be president and general manager. The company has purchased limestone and clay properties on Mariel Bay, Cuba, twenty-eight miles southwest of Havana, and will erect a plant having a capacity of 600,000 barrels a year.

NEW CEMENT MILL

Some time this month the finest cement plant in the world, from point of equipment, will be started in operation in Houston. It is now almost done, the property of the Texas Portland Cement Company. It will employ 250 men and its initial capacity will be 1,500 barrels of cement a day.

This fine plant will represent an investment of about $750,000, and it could not be duplicated, if the contracts were let today, for less than $900,000, the officials say. This is because since the contracts for the plant were let materials have gone up enormously.

The burning kiln of the Houston plant is 220 feet long. The cement will be made of oyster shells, taken from the bottom of the bay. The big dredge that will scoop the shells up will go to work on Red Fish Reef, gnawing at the bottom of the sea for materials for the building of houses, the making of roads and sidewalks and business blocks.

The cement will be made by the "wet process." The ground shell and clays used are mixed together until it takes on a consistency of thick pea soup. Then it is baked and ground and "processed" a number of times.

Mayor Campbell has asked the cement company for the first 10,000 barrels of its product for city projects. Within a week or two plans will be announced for the opening of the plant. Officials from Dallas, where another plant is maintained, and elsewhere, will be in the city.

Mayor Campbell, city and county officials, and a number of prominent Houston men will take in the opening.

Statement of the ownership, management, circulation, etc., required by the Act of Congress of August 24, 1912, of CEMENT AND ENGINEERING NEWS, published monthly at Chicago, Illinois, for April 1, 1916.

State of Illinois.
County of Cook.
ss.

Before me, a notary public in and for the state and county aforesaid, personally appeared Jno. F. Waldron, who, having been duly sworn according to law, deposes and says that he is the business manager of the CEMENT AND ENGINEERING NEWS, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, Wm. Seafert, 672 Transportation Bldg., Chicago, Ill.

Editor, Wm. Seafert, 672 Transportation Bldg., Chicago, Ill.

Managing Editor, Wm. Seafert, 672 Transportation Bldg., Chicago, Ill.

Business Manager, Jno. F. Waldron, 672 Transportation Bldg., Chicago, Ill.

2. That the owners are: (Give names and addresses of individual owners, or, if a corporation, give its name and the names and addresses of stockholders owning or holding 1 per cent or more of the total amount of stock): Wm. Seafert, 672 Transportation Bldg., Chicago, Ill., sole owner.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages or other securities are: (If there are none, so state.) None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest, direct or indirect, in the said stock, bonds, or other securities than as so stated by him.

JOHN F. WALDRON.
Business Manager.

Sworn to and subscribed before me this 24th day of March, 1916.

(Seal) MICHAEL J. O'MALLEY.

(My commission expires March 8, 1920.)

A Modern Rock-Crushing Plant

BY PRESTON K. YATES*

SYNOPSIS

In our February issue there was published a description of the large rock crushing plant at Tomkins Cove, N. Y., which was designed by and erected under the direction of Preston K. Yates, chief engineer. Mr. Yates has recently designed and erected the new plant described in this article.

Most of the crushed trap rock for the supply of New York City and vicinity has hitherto been obtained from the great deposits of trap rock on the western bank of the Hudson River. Fifteen years ago the states of New York and New Jersey joined in a movement to stop the injury to the Hudson River scenery by the operation of the quarries, and created the Palisades Interstate Park Commission with authority to condemn and acquire the quarry properties. The commission now controls the entire river frontage for the length of the Palisades, some 15 miles, and at Hook Mountain, 35 miles north of the city, which has been in recent years the chief source of trap rock supply, the Commisison has now acquired and closed all the

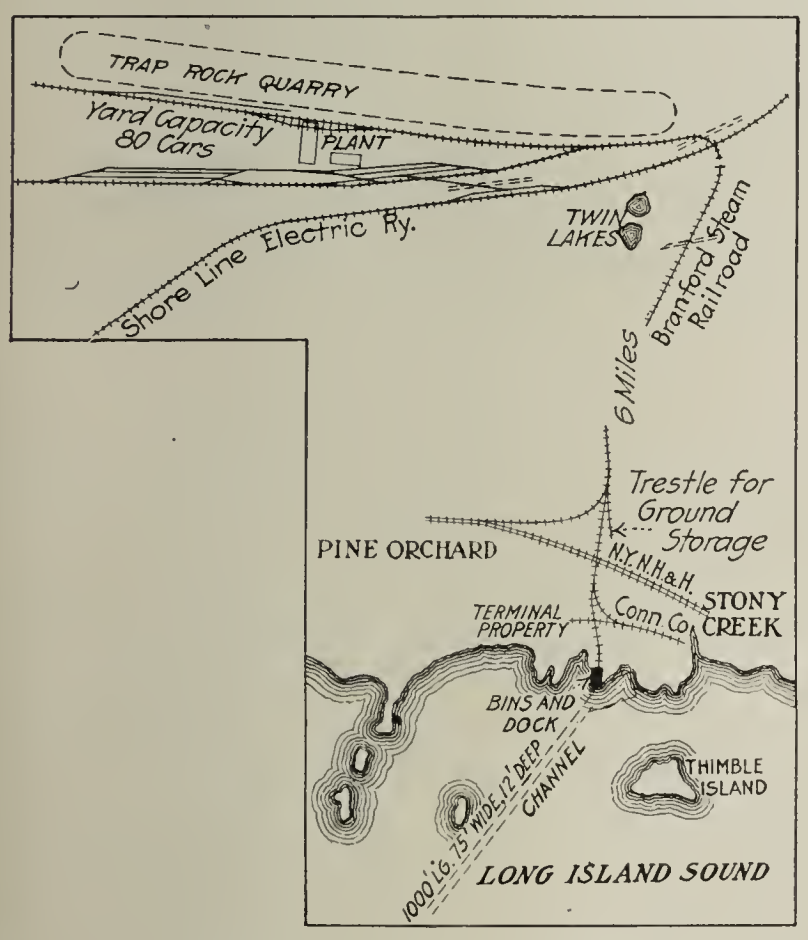

Fig. 1. General Plan of Quarry and Shipping Facilities of New Haven Trap Rock Co.
(The relative location of quarry and shore is greatly distorted by a shortening of the map.)

trap rock quarries save one, on which condemnation proceedings are in progress.

The closing of these nearby sources of trap-rock supply has made possible the development of more distant sources. A project which originated many years ago to develop a great deposit of trap rock in southern Connecticut has within the past year been carried into effect. At North Branford, Conn., nine miles east of New Haven, the New Haven Trap Rock Co. has opened quarries and created a stone-crushing plant and shipping facilities which will doubtless become one of the largest crushed-stone enterprises in the United States.

Totoket Mountain, on which the trap-rock deposit occurs, is a broad plateau several miles in length, on which an underlying stratum of sandstone is covered with a sheet of trap rock 150 feet or more in depth. The company has acquired title to 600 acres of land for its quarry property; and if the marketable trap rock on the tract be estimated at no more than half a million tons per acre, it is readily seen that the quarry is practically inexhaustible.

In 1914 the writer was placed in charge, as chief engineer and general manager, of the work of developing this quarry and creating facilities for crushing the rock and shipping it to market. The general plan of the entire operation is shown in the accompanying sketch map, Fig. 1. The trap-rock deposit which forms the top of the mountain is covered with but a thin layer of soil. The face of the hill for a long distance is very abrupt. Along this steep slope a quarry face has been opened some 5,000 feet in length and 50 feet in height. The trap of Totoket Mountain shows the columnar formation to a remarkable extent; and when lifted by a blast, it breaks up into fragments of small sizes, leaving very few chunks so large that they require dobey shooting in order to be handled by a steam-shovel dipper.

In working this quarry face, the present practice is to drill horizontal "snake" holes at the quarry floor about 30 feet deep and 10 feet apart. After springing the holes, they are charged with 60% dynamite. About twenty holes are loaded and fired at one time, lifting an area of ledge about 200 feet long and 30 feet in depth back of the working face. Instead of the horizontal drill holes, well drills may be used for drilling, but the quarry may eventually be equipped with compressed air.

As the face has now been developed, there are two distinct quarries, so that if one is shut down to extend track or for other reasons, the other quarry may keep up the supply of rock to the crushers. The plan of operation is to take off a layer of rock 50 feet in height over the entire area. Another quarry will then be opened on a level 50 feet lower and the operation continued as before.

Steam shovels loaded the blasted rock into side-dump steel cars of standard gage and about eight-ton capacity, and as fast as a train of these cars is loaded it is taken to the crusher plant over a 2% down grade by 45-ton locomotives.

The crushing plant is built on the steep side-hill slope below the quarry level. The steep slope was a great advantage as it made possible the flow of the rock by gravity through the crushing house. The soft sandstone of the side hill was excavated until a series of benches was formed; heavy concrete retaining walls were built at the sides, and on these walls was erected the steel-frame superstructure which, besides carrying the roof and sides that protect the machinery from the weather, supports runways on which are placed traveling cranes for handling the heavy machinery.

The building is 40 feet in width and 210 feet in length. Its general appearance and the arrangement of the machinery in it are made clear by the accompanying drawings and photographs. A railway runs through the building on the upper level. The loaded trains from the quarry enter on this track and as each car comes opposite the hopper over the big jaw crusher its load of broken stone is dumped into the hopper.

---

*Consulting Engineer, 120 Broadway, New York City.

After dumping, the empty cars go on out of the building and are switched back on a return track to the quarry.

The crusher which first receives the broken stone is a jaw crusher having an opening 48 inches wide and 72 inches long. The opening through the jaws of this crusher is 10 inches in width; and as a large part of the rock from the quarry is broken up by the blasting into pieces smaller than this, the rock passes through this crusher very rapidly. From the bottom of this crusher the rock falls by gravity into the hopper of a No. 10 Allis-Chalmers gyratory crusher, which reduces the rock to a maximum size of 5 inches. By the time the rock leaves this crusher, a considerable proportion has already been crushed into market sizes, so the stream of broken rock is carried upward by an inclined belt conveyor to a scalping screen. The stones already broken to market size drop through the perforations in the screen and fall down a chute to a conveyor belt, which carries them to the main conveyor belt to the storage bins.

The stone which requires further crushing passes the length of the scalping screen and is delivered by a belt conveyor to a battery of four No. 6 gyratory crushers. These reduce nearly all the stone, none of which, it will be remembered, is over 5 inches, to market sizes. The stone discharged from this battery of crushers is carried by a belt conveyor to a pair of scalping screens placed in parallel. Any tailings passing these screens fall into a pair of Symons disc crushers, which may be adjusted to break the stone as finely as may be desired.

The three streams of broken stone—that from the first scalping screen, that passing the screens beyond the four No. 6 crushers, and that leaving the Symons disc crushers—are all delivered to the foot of a conveyor belt leading from the lower end of the crushing house to the top of the screening and shipping-bin house, shown in Fig. 3. This is a huge rectangular wooden bin, 100 feet long, 35 feet wide and 30 feet high, divided into six compartments, each containing a special size of stone.

Over these bins are two pairs of revolving screens, the first pair of which receives all the stone brought up from the crushing house by the conveyor belt. These screens take out all the 2-inch stone and 1¼-inch stone and drop it into the first two bins, discharging all the finer stone upon a conveyor belt, which delivers it to the second pair of screens.

The jackets of these screens have ⅜-inch holes for the first half of their length and ⅝-inch holes along the second half. All stone passing through the ⅜-

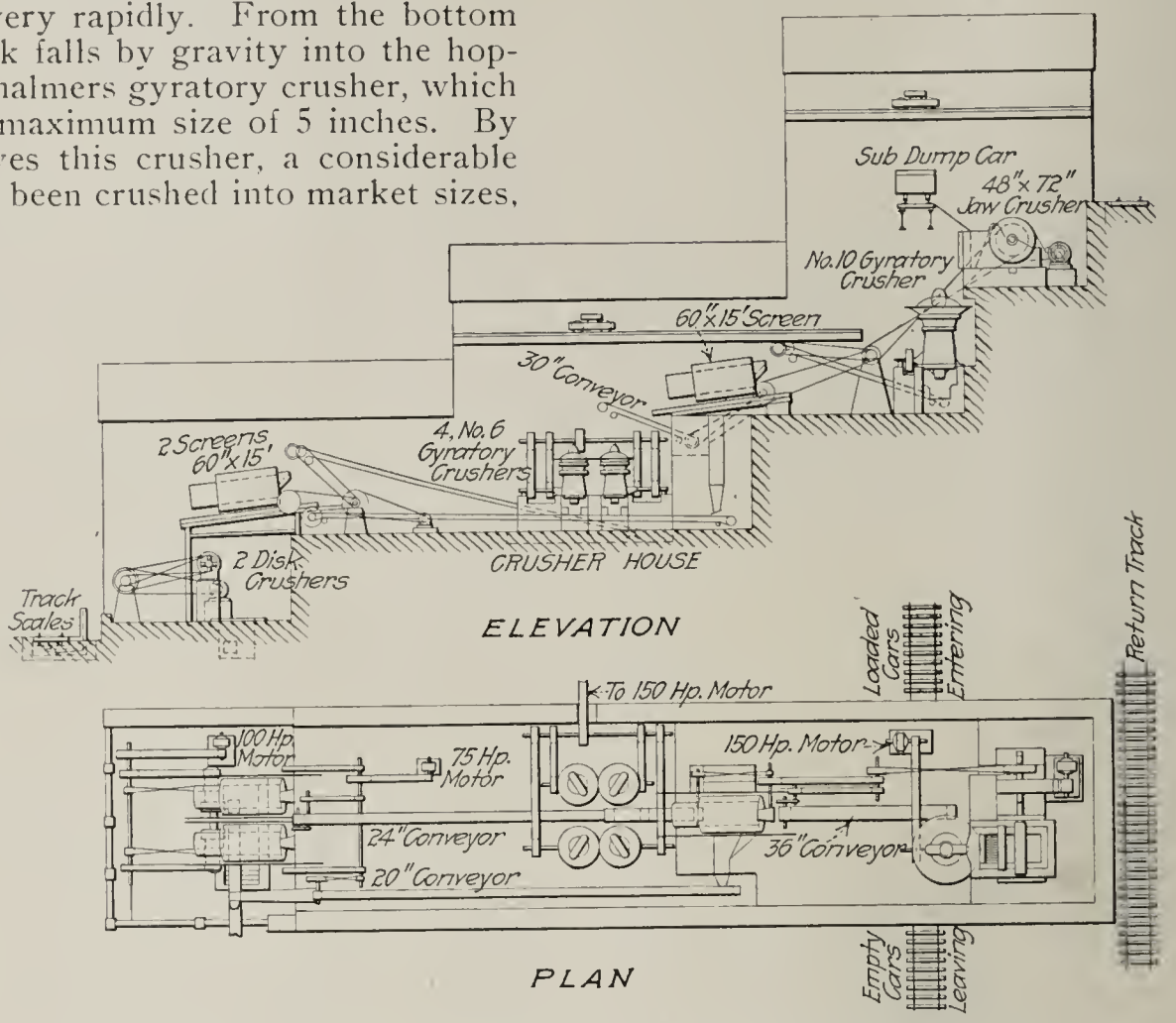

Fig. 2. Plan and Longitudinal Section of Crushing Plant.

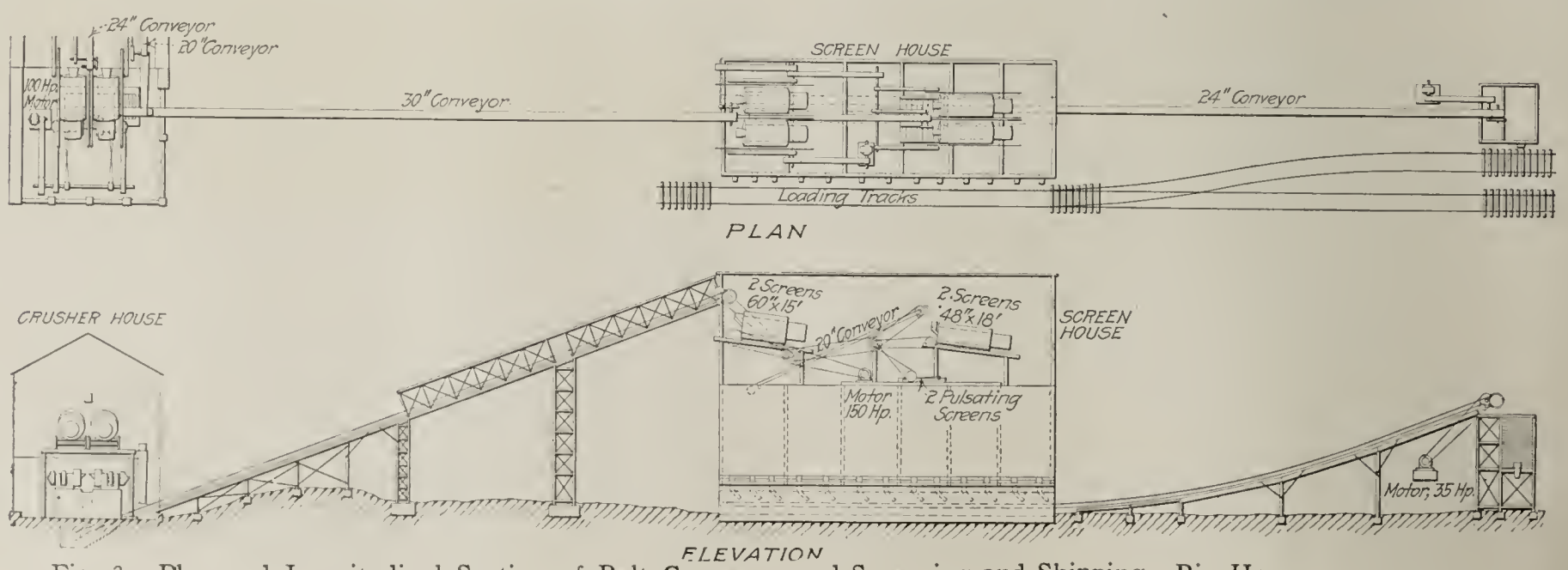

Fig. 3. Plan and Longitudinal Section of Belt Conveyor and Screening and Shipping—Bin House.

inch holes falls upon a pair of pulsating screens, one located under each revolving screen. These clean the stone and separate the dust and dirt from the ¼-inch stone. The ⅝-inch holes in the screen jackets remove the ½-inch stone, and the tailings from the screen give 1-inch stone, while from the jacket comes ¾-inch stone.

The seven revolving screens are manganese steel throughout. The first five are made from the same pattern, the only difference being in size of the holes in the screen plates. Each screen is equipped with a dust jacket in which the holes are smaller than those in the main screen. This greatly increases the capacity and efficiency of the screens.

On account of the continual forward movement of the crushed stone through the crushers and screens, the output is greatly increased, as no tailings are brought back to the crusher. The opening in the crushers can be adjusted so that if one crusher be-

Fig. 4. Typical View of Quarry Face.

comes overloaded and flooded with stone its opening can be increased or the opening of the crusher back of it may be reduced. This gives maximum capacity for all crushers.

Should the initial crusher be out of commission, the stone can be fed direct from the quarry cars to the No. 10 crusher. Should the No. 10 be out of commission the stone can pass from the jaw crusher direct to the four No. 6 crushers. The screens can be operated singly or in pairs as production requires, and any screen may be stopped for repairs without stopping the whole plant. It would require a series of accidents to put the entire plant out of commission, as any crusher can be bypassed.

Especial attention has been given to standardization throughout the plant and as few different sizes are used as possible. This reduces the stock of spare parts to be carried and the chance of errors in making repairs.

Care has been taken to avoid wear where the stream of stone enters and leaves the belt conveyors, the endeavor being to make stone fall on stone rather than on steel chutes. All skirt-boards are free from contact with the belts and are held by braces fastened to the stringers below the conveyors.

An interesting feature in the design is that when necessary the entire plant of eight crushers can be duplicated within the present building without moving a single crusher from its present location.

The entire crushing and screening plant is driven by seven electric motors, one of 250 hp., three of 150 hp., and one each of 100, 75 and 35 hp. The 250-hp. motor drives the big jaw crusher, which requires about 200 hp. under normal conditions, but in cold weather and when starting under a load it sometimes calls for considerably more. The 250-hp. motor therefore drives also the first scalping green and two belt conveyors which run empty until the jaw crusher has begun running and started the stream of stone.

On account of the limited room between the jaw crusher and the rock wall at the upper end of the power house, the motor was placed close to the crusher, the shaft centers being only 10 feet apart. A "Lenix" drive has been installed on the belt by which the motor drives the jaw crusher. This drive is essentially a counter-weighted idler which rests on the slack side of the belt and greatly increases the arc of contact on both pulleys.

The electric current to operate the plant is transmitted at 6,600 volts over a private pole line seven miles from the power-house of the New Haven Electric Co. This three-phase current is delivered to a bank of outdoor transformers which deliver current at 550 volts to the main switchboard, located in a small building entirely outside the crusher house. All of the motors are of the slip-ring type, with outside dust-proof collector rings, and all motors of 100 hp. or over have three bearings.

To furnish water for the works, a pumping plant was erected at a small lake about a mile distant. Part of the 6,600-volt current is stepped down to 2,200 volts by a small transformer at the crusher house, and is transmited thence to the pumping station, where it is further stepped down to 220 volts for running the pump motor.

Returning now to the screen house, the six rectangular bins in this house have a combined capacity of 3,000 cu. yd. The stone from these bins can be delivered either directly into railroad cars run alongside the bins or the bins can be emptied from the bottom upon a belt conveyor running through a tunnel underneath the center of the screen house. This belt conveyor delivers the stone into a small shipping bin, from which it may be chuted directly into a railway car, as will be evident by the plan view. Of course,

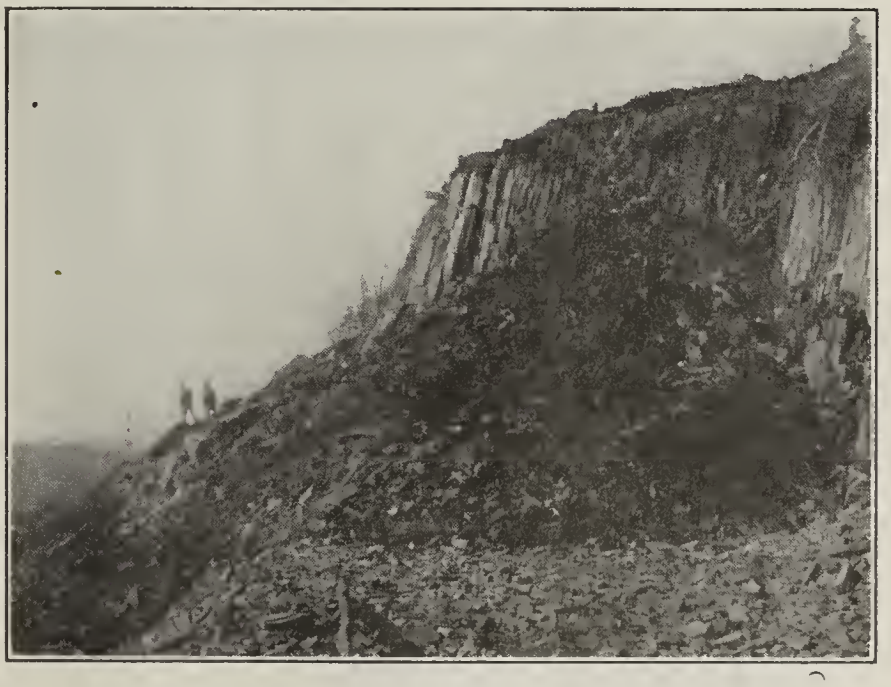

Fig. 5. Mass Rock Broken Up By Blast.

the stone is as a rule drawn from the chutes in the side of the bin. When, however, there is a particular demand for one size of stone it may be necessary to draw the bin down below the level of the side chutes, and under these conditions the bottom chutes and the belt conveyors are used.

A yard, with capacity for 40 standard-gage railway cars, is located just east of the screen house. The empty cars run by gravity down to the screen house,

where they are loaded, and then pass over track scales at the end of the crusher house, and thence to a loaded car yard of 40 cars' capacity. Here the loaded cars are made up into trains for hauling to tidewater, six miles distant. The line is direct and the grade is easy in the direction of the traffic.

At the tidewater terminal, which is about 70 miles distant from New York, the cars may be dumped into storage bins of about 4,000 cu. yd. capacity or they

Fig. 6. View of Crusher House.

Fig. 7. Shipping Bin and Screen House Under Construction.

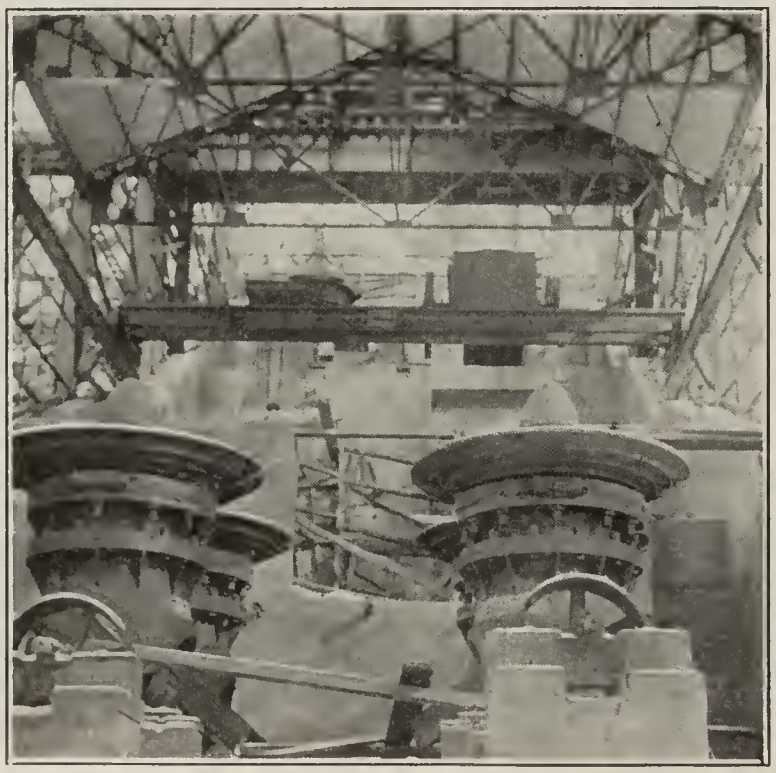

Fig. 8. Group of Four No. 6 Crushers With Jaw Crusher Above in Background.

may be dumped from a high trestle on a ground storage area where an unlimited amount of stone can be stored. For shipping stone by water the scows are loaded by belt conveyors from the storage bins. A basin has been dredged sufficiently large to hold the scows and channel extending from the basin out to deep water, a distance of about 1,000 feet. Direct connection is also made at this terminal with the tracks of the New York, New Haven and Hartford R. R. and of the Connecticut Company's electric line, while the Shore Line electric railway intersects the company's railway near the quarry.

The entire work of constructing and equipping the quarry and mill was placed in charge of the writer, and the work was done by day labor under his direction. In connection with the design and erection, credit is also due to Sheldon S. Yates, Principal Assistant Engineer, who is now associated with Preston K. Yates under the firm name of Yates & Yates, Engineers, 120 Broadway, New York City.

PROTECTING RIVER BANKS WITH CONCRETE.

The advantages of protecting the river banks by revetments of concrete that would be practically permanent and at the same time would present a smooth surface to the flowing waters have long been recognized by the army engineers who have charge of the improvement work in the lower Mississippi, but all attempts to make use of such protective structures have proved failures because the swift currents have disintegrated the concrete before it became hard. By a little careful experimenting the specialists assigned to the problem at the bureau of standards have found that by adding 4 per cent of calcium chloride—and inexpensive substance—to the water used in mixing concrete the material has twice the strength of ordinary concrete at the age of a day and in some cases is three-fourths as strong and resistant at the age of two days as ordinary concrete is when a month old. The newly discovered mixture will probably be tried out on the Mississippi in the near future.

LINK-BELT CATALOGUES

The Link-Belt traveling water-intake screens are illustrated and described in bulletin No. 229, which has just been published by the Link-Belt Co., whose works are located in Philadelphia, Chicago and Indianapolis. Arguments showing why these screens should be used in preference to stationary screens are convincing, as they are presented from the standpoints of economy, sanitation and service. Other bulletins recently issued by the company are No. 264, entitled "Shoveling Coal by Machinery," and No. 267, entitled "Moving Material Indian File." Both of these publications have been written by Henry J. Edsall, M. E., and are generously illustrated with pictures showing the various uses of Link-Belt conveying systems.

LUNKENHEIMER MOTOR ACCESSORIES

Generator Valves, Carburetor Check Valves, Gasoline Strainers, Relief Cocks, Needle Valve Priming Caps, Emergency Gasoline Cocks, Exhaust Pressure Regulators, Dash Sight-Feeds, Motorcycle Valves, Gauges, Oilers, Grease Cups and other Automobile and Motor Boat Equipment form the subject of Catalogue No. 4 of the Lunkenheimer Co., the largest manufacturers of High Grade Engineering Specialties, of Cincinnati, New York, Chicago and Boston.

This catalogue of Motor Accessories is, like all former catalogues of the Lunkenheimer Co., profusely illustrated and splendidly gotten up. It will be a handy book of reference welcomed by all automobile owners.

CAREY BUILDING MATERIALS

The Philip Carey Co. of Cincinnati, Ohio, describe and illustrate in their latest publication Roofing Material, Ceil-Boards and Pipe Coverings, and give detailed specifications for these materials, which will enable Architects, Engineers, Contractors and Prospective Builders to make the proper selection of these building materials.

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We have recently organized a new Contractors' Plant Department to handle the sale of a line of small rock and ore crushers, with which we will furnish our well known line of elevators, conveyors and screens, writes the Jeffrey Manufacturing Company, 914 North Fourth St., Columbus, Ohio. We will specialize in the manufacture of small crushers only, which will fit in with certain well established Jeffrey lines such as pulverizers, loaders and sand and gravel machinery. These machines have been developed and are particularly adapted for use in the following fields:

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Mr. Leroy A. Kling, formerly sales manager of the Road Machinery and Limestone Crusher Department of the Wheeling Mold and Foundry Company, Wheeling, W. Va., will be in charge of this department.

We are interested in hearing from agents who are qualified to handle the sales of these products in their territory.

CONCRETE BLOCKS FOR PARTITION WALLS —ESPECIALLY WHERE COMPLETE SOUND INSULATION IS IMPERATIVE

"Prospects are bright for an active building season," said Fred Goepper, manufacturer of concrete building blocks, whose plant is at West Michigan street and the C., H. & D. Railway, Indianapolis.

"The advantages of well-made concrete blocks for many lines of construction are generally understood. They are in demand for garages, for many kinds of foundation, for store buildings and for partition walls —especially where complete sound insulation is imperative. Manufacturers have found that for complete sound deadening, a properly constructed concrete block wall excels. Such walls have been installed in parts of the Link Belt Company's plant in Indianapolis.

"Our plant ships blocks within a radius of about seventy-five miles of Indiana and the market for our commodity is growing steadily."

A CONCRETE "DOPE" BOOK

One of the most interesting books ever published by a manufacturer of concrete machinery has just been compiled and published by the Cement Tile Machinery Co., 661 Rath Street, Waterloo, Ia. It is known as the "Concrete Dope Book," and contains valuable information relative to the amount of materials required for various kinds of work, cost of materials, cost of making concrete products and additional tables and data treating with the use of concrete.

Numerous helpful suggestions are contained within the book which consists of thirty-two pages and cover and is printed in a six-by-nine-inch size. The publishers explain their reason for including these hints to the concrete worker in the following words:

"Deviating from the usual routine of issuing merely a catalog, we have taken the concrete man's problems into consideration, and have combined a few pages illustrating and describing "Winner" mixers with a few pages of concise information that we feel will be of value to the contractor in his every day work."

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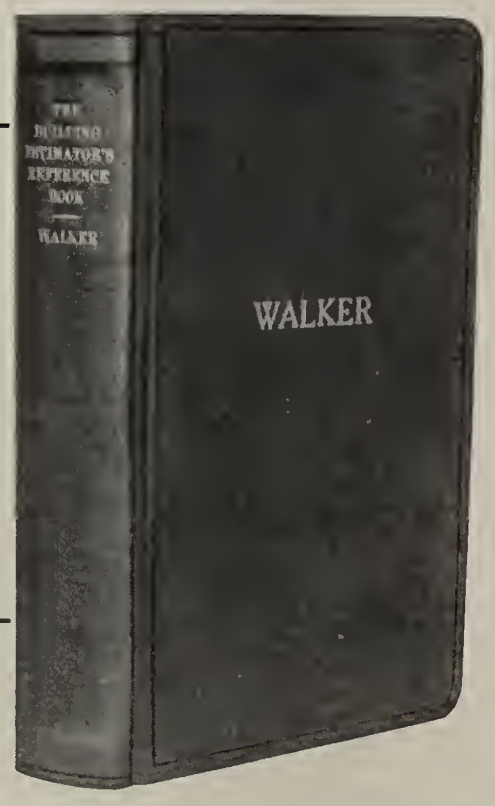

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Cem. News. Apr. 16.

LARGE ORDER FOR CEMENT

The board of county commissioners, Everett, Wash., signed an agreement with the Washington-Portland Cement Company to purchase 125,000 barrels of Portland cement, at $1.56 per barrel, f. o. b. factory, or $1.75, delivered in Everett, for use in paving roads. This company's bid was accepted as the lowest bid submitted. In the contract the terms of sale, delivery, and quality of the cement are definitely specified.

"It is agreed," says the contract, "that should the market price of cement fall lower than the contract price herein specified, then the purchaser shall have the privilege of purchasing cement at such reduced price from other parties, but before exercising such privilege the purchaser shall notify the seller and the seller shall have the option of furnishing cement at such reduced price if it elects to do so, and no cement shall be purchased from other parties if the seller is willing and ready to furnish the same at such reduced price."

GRAVEL FREIGHT RATES

The Missouri Pacific Railroad has been ordered by the railway commission to discontinue a $3 per car rental charge on cars used by the Superior Gravel and Sand Company at its pits near Superior, Neb. The charge was in addition to the regular switching tariff of $5 per car.

GRAB BUCKETS

Two standard types of grab buckets, AE and ZB, manufactured by the Link-Belt Co., Chicago, are described in a circular issued by the manufacturer. These types are built for hard service and are said to be winning constantly increasing recognition for handling all kinds of materials through their ruggedness and capability.

WILL BE KNOWN HEREAFTER AS SANDUSKY CEMENT COMPANY

The corporate title of The Sandusky Portland Cement Company, Cleveland, Ohio, has recently been changed to that of "The Sandusky Cement Company," the officers and directors in the new company being the same as those of the old concern. There will be no other changes of any kind whatever, the business of the company being carried on as formerly, but the trade is requested to make special note of the new title and make use of the same in all correspondence.

"LIGHT TEN" CONCRETE MIXER

The Republic Iron Works, Box 454, Tecumseh, Mich., is calling the attention of builders to its Republic "Light Ten" concrete mixer, which combines a number of "money-making features." It has, among other things, a 26-in. opening for easy cleaning; a large 34-in. cast hopper for rapid and easy loading; a rapid 12-second discharge; a 24-in. low charging platform with automatic power loader if desired; heavy glass and a compact steel construction.

CLAY BLASTING BOOKLET

The E. I. du Pont de Nemours & Company of Wilmington, Delaware, have just had printed a Clay Blasting Booklet. As it is the first booklet ever issued on this subject it contains valuable and interesting information. Some of the phases covered are "Digging Clay," "Stripping," "Blasting Down Shale," "Digging Plastic Clays," "Mining Flint Clays," "Draining Clay Pits," as well as full information on the use of explosives.

The booklet will be sent to any address upon request.

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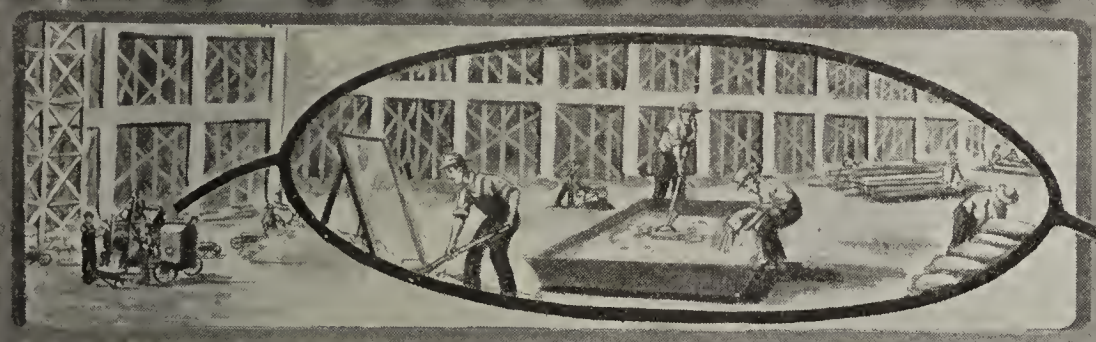

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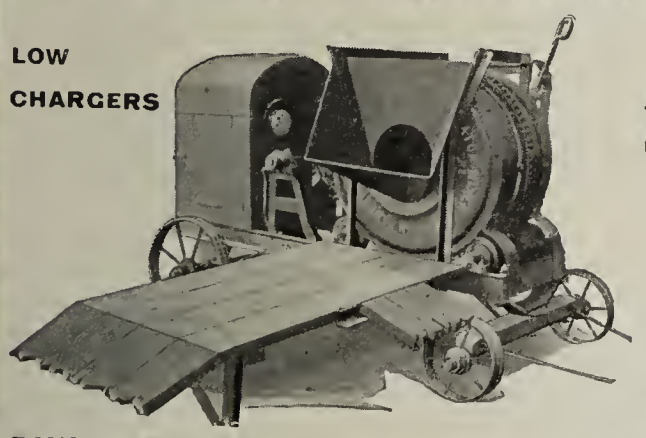

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Why not make Vaults?

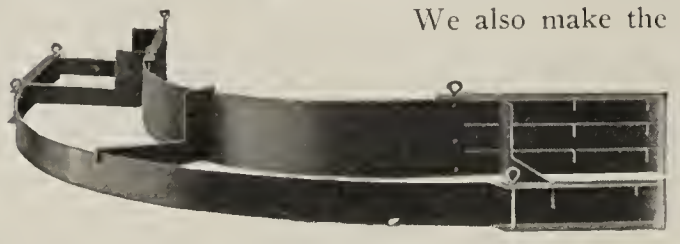
Have you ever investigated the money-making possibilities of the Concrete Burial Vault Business?

It is one of the most profitable branches of the Concrete Industry—either as a side line, or as a business in itself. You can make from $15 to $20 profit on every

AUTOMATIC SEALING VAULT

that you turn out. And you don't need any experience, or selling ability. Any man can manufacture Automatic Vaults, and they sell themselves. They are handsome in appearance, an everlasting protection against water, dampness, and decay; and are cheap enough for everybody. It doesn't cost much to start this business, and costs you nothing to investigate.

We also make the



Indiana Steel Forms—

for sidewalks, and curb-and-gutter.

During the next thirty days these well-known money-saving forms will be offered at the following prices:

Offer No. 1. For $28.40 you can buy enough steel forms to lay 125 running feet of sidewalk per day—4 feet or 5 feet wide.

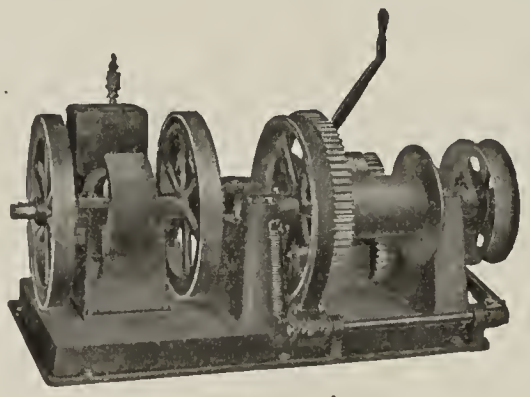
Offer No. 2. For $40.20 you can buy enough steel forms to lay 200 feet of sidewalk per day—4 feet or 5 feet wide.

Offer No. 3. For $59.00 you can buy enough steel curb-and-gutter forms to lay 50 running feet of curb and gutter 17 inches wide at one setting of the forms.

The Automatic Sealing Vault Co.

216 E. River St., Peru, Indiana

BUILDERS' HOISTS and MATERIAL ELEVATORS



Hoist and Engine complete, direct connected, three sizes, 5, 6 and 8 H-P.

Every up-to-date builder and contractor should post himself on the most economical way to elevate building material. We have prepared an interesting booklet on

HOISTS and ELEVATORS

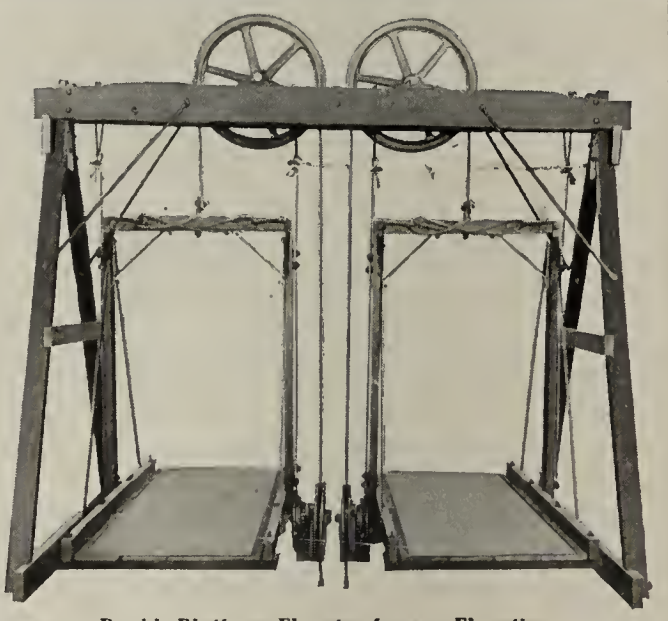
which we will send to anyone interested.

Write for it.

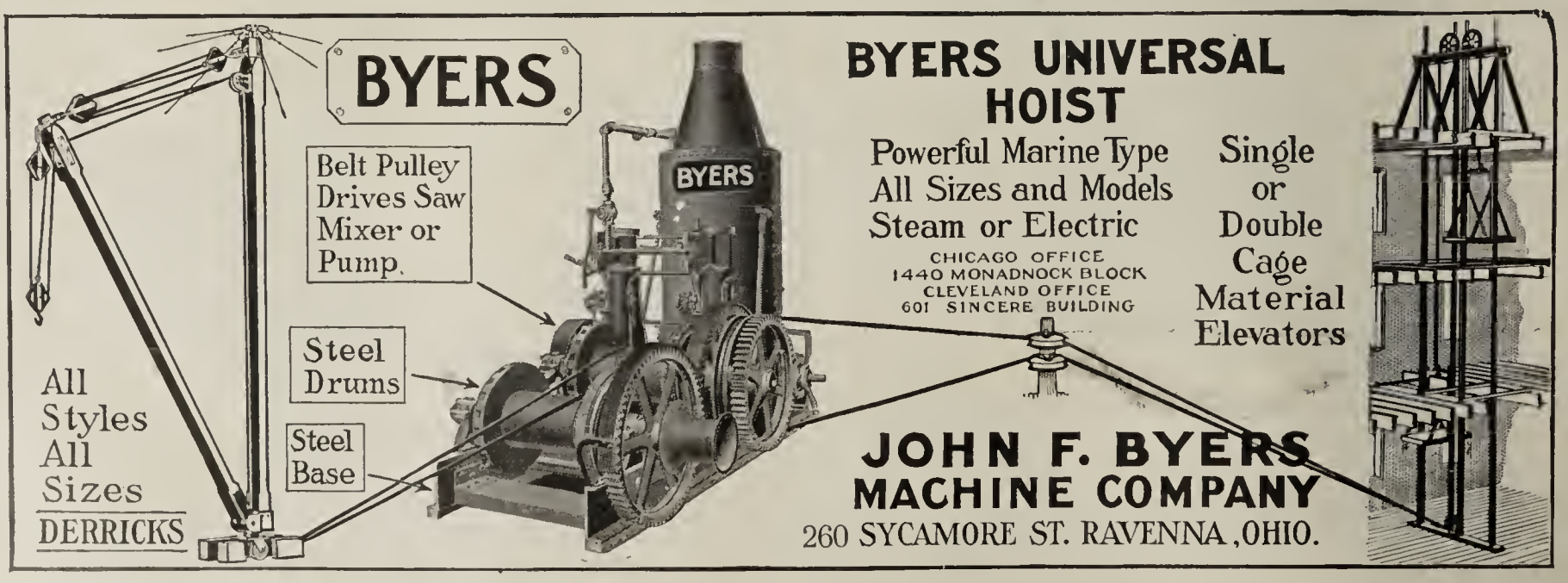
Bates & Edmonds Motor Co.

114 Hill Street

Lansing, Mich., U. S. A.



Double Platform Elevator for any Elevation



BUILDERS' HOISTS

A great many times the labor of laying brick and other materials is considerably less than getting the materials to the workmen. On buildings over two stories high, a mechanical hoist is an absolute necessity. Possibly the simplest way of getting materials up is by the use of a wheelbarrow platform elevator. This entire apparatus can be set up in a few hours and is a means of saving a great deal of labor in getting materials to the upper stories.

Not only must the platform be well made to carry the materials, but the guides must be so constructed that they will keep in place, and the engine must be suitable to hoist the material rapidly and not be subject to delays or breakdowns.

The apparatus designed by the Bates & Edmonds Motor Co., 114 Hill Street, Lansing, Mich., provides all the facilities which the ordinary job requires in the hoisting line. This company manufactures contractors' elevators equipped with either gas engine or electric motor. The hoist is provided with a drum for hoisting either a single or double line of platforms operating with a simple friction clutch drive. A powerful brake is provided, operated by the foot, thus making it a one-man machine.

This hoist is designed not only for contractors' use, but it will be found valuable wherever any kind of hoisting is to be done. Some have used it with great success for hoisting ice and coal, while others operate hay carriers, pile drivers, derricks, etc.

Bulletin No. 114 issued by the Bates & Edmonds Motor Co. describes all of the above apparatus in great detail. The contractor or owner having use for this class of machinery will have no difficulty in selecting the particular machine best suited to his needs.

LANSING COMPANY'S NEW CATALOGUE

The Lansing Company's new catalogue 354-P is now ready for distribution. The elaborate make-up of this catalogue merits much comment. This catalogue covers in detail every type of Concrete Mixer manufactured by the Lansing Company, in splendid manner. In preparation of this catalogue neither time nor effort have been spared in making it superior to any previously issued. This is obviously seen in 354-P.

Every model of mixer shown in this catalogue is described in the most explicit form, the illustrations being clear and sharp. Both continuous and batch mixers are shown in this profusely illustrated catalogue. It also contains description of mortar mixers, concrete barrows and carts. An engine hoist is also given place in this list.

This catalogue should certainly be on the desk of every cement and concrete worker in the industry. If you have not yet applied for one, you should do so at once, for the constant demand is causing the present supply to diminish rapidly.

Buyers have the advantage of prompt shipments and low freight rates, as the Lansing Company has warehouses at all important points and jobbing stocks everywhere. This company is prepared to furnish goods exactly suited to the necessities of all classes of the trade, owing to their unusually large line of unparalleled concrete machinery and construction equipment.

Thirty-four years in business has placed this company in a position where no order is too large to be filled with dispatch, and none too small to receive prompt and personal attention.

Just drop the Lansing Company, Lansing, Mich., a card, and they will gladly send you a catalogue.

The New Lansing Roadster

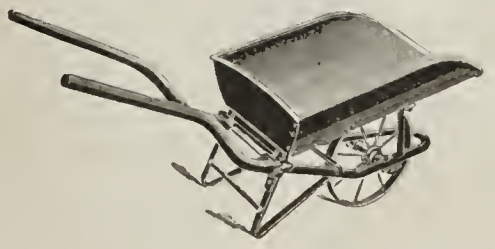
The Mixer for the Country Contractor

BECAUSE:

It has **24-inch front,** and **30-inch rear,** wheels.
It **follows the wagon track.**
Its **hammock bearings** absorb the bumps in the road.
Its power plant is the best mixer engine on earth—**Novo** or **Ideal.**
All wheels and bearings have **hard oil cups.**
You can have it with **sideloader** or **batch hopper, water tank** or **folding platform.**
For bridge builders it has a **rotary pump.**
For silo men it is equipped with **special silo hoist.**
The **weight is light.**
The **price is right.**
Ask about the ***Lansing Roadster,*** *Catalog 354-M.*

LANSING COMPANY
"KEEP YOUR PRODUCT ON WHEELS"

The Home of the Lansing Wheelbarrow



LANSING, MICHIGAN, U. S. A.

CHICAGO, 169 W. Lake St. PHILADELPHIA, Willow and N. Amer. Sts. NEW YORK, 288-289 West St.
MINNEAPOLIS, 517-519 N. Third St. SAN FRANCISCO, 338-348 Brannan St.
KANSAS CITY, 1413-1415 W. Tenth St. BOSTON, 78 Cambridge St., Charlestown Dist.

WRITE FOR CATALOG 354-M and mention Cement & Engineering News

Pioneer Excavating Outfits

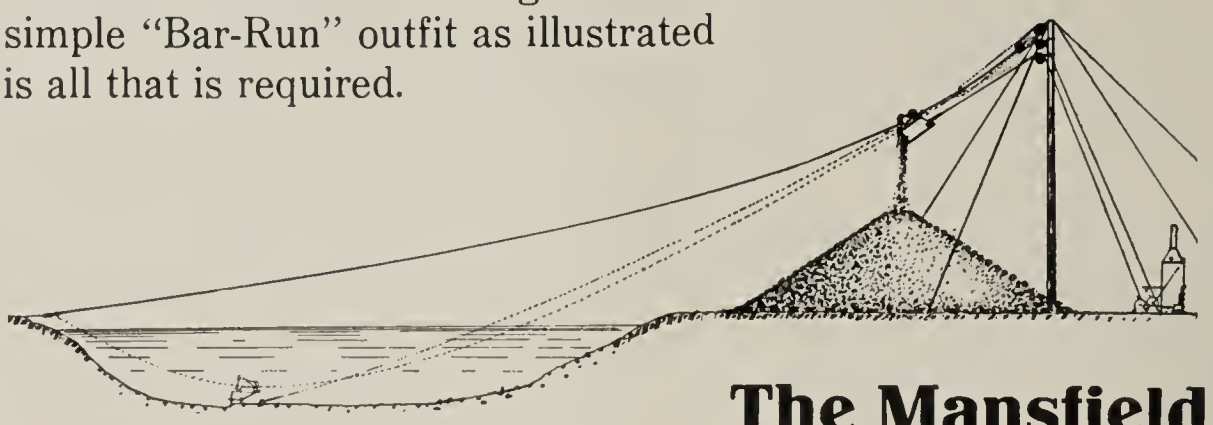
Are the Money-Makers that all live, up-to-date contractors are using for excavating their own gravel. Don't buy any gravel of a dealer until you investigate our plans and prices.

A regular one yard outfit for a 400′ span is as follows:

1-One yard PIONEER Back-Dump Bucket
400′-1⅛″ Track Cable
550′- ⅝″ Drag Cable
450′- ⅝″ Tension Cable
1000′-1 ″ Cable for six guys
2-14 ″ Single wire rope blocks
2-14 ″ Double wire rope blocks
15-1⅛″, 50-1″, 25-⅝″ Cable Clips
1-8¼″x10″ Double Drum Hoist Engine

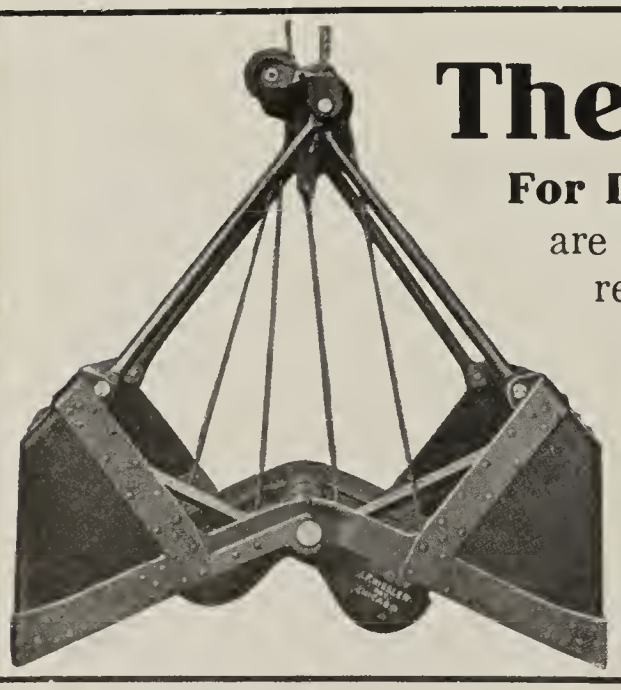
The Pioneer Back Dump Bucket

Are used for either wet or dry excavation of gravel or any other material. No time or power lost in dumping, as it is instantaneous and automatic. For road gravel the simple "Bar-Run" outfit as illustrated is all that is required.



If it is worth a two-cent stamp to you; send for our Booklet No. 15, it will tell you all about it, and we will be glad to quote our prices on the above.

The Mansfield Engineering Co.
Indianapolis, Ind. **10th Floor Fletcher Bldg.**



The Kiesler Grab Buckets

For Digging Sand, Gravel, Crushed Stone, Clinker, Etc.
are superior to any other buckets on the market for the following reasons:

1st They have powerful (patented) digging action.
2nd They are durable.
3rd They are simple in Construction.
4th Few parts—Few repairs.

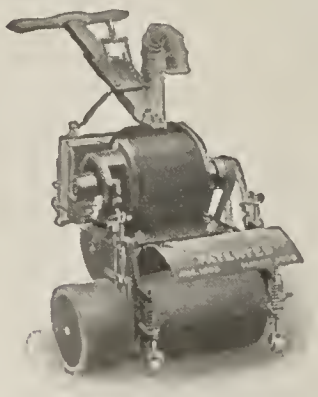
On account of the EFFICIENCY and SUPERIORITY of our buckets we GUARANTEE them to give full satisfaction.

A few of our many satisfied customers are: The France Co., Toledo; Erie Crushed Stone Co., Huntington, Ind.; Thomas Sand & Gravel Co., Williamsport, Pa.; Hydraulic Sand & Transit Co., Chicago, etc., (the last named Company discarded two other makes for our buckets).

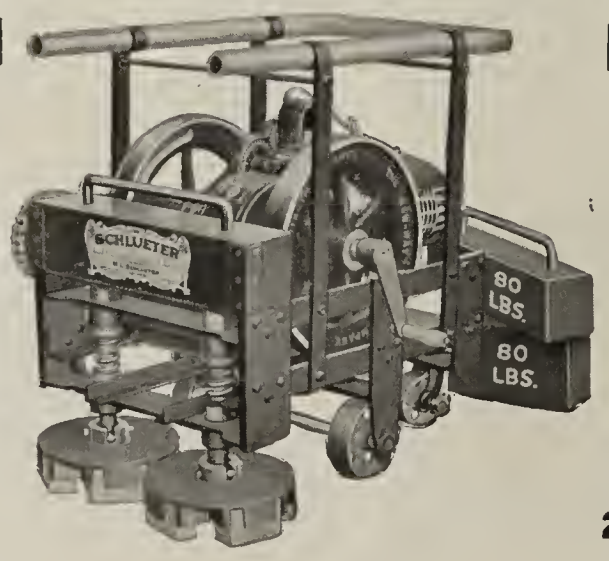
Write for catalog and prices **Jos. F. Kiesler Co.,** **Sangamon and Huron Streets CHICAGO, ILL.**

TEST AND TRY BEFORE YOU BUY—THE

Schlueter Rapid Floor Surfacer



The Schlueter BALL BEARING electric floor surfac ng machines for mosaic, marble, composition and wood floors are the most simple constructed machines on the market. Direct chain drive AUTOMATIC DUST COLLECTORS.



No gears or clutches to wear.

Made in various styles.

OVER 5,000 IN USE ALL OVER THE WORLD

Send for prices and free trial proposition

M. L. SCHLUETER CO. **225 W. Illinois St., CHICAGO**

Bungalow of Mr. Edgar W. Smith, Madison, Wisconsin, covered with concrete roofing tile.

Concrete Roofing Tile

One of the most perplexing problems to solve in buildings of all kinds is a durable roof of medium price. There are cheap roof coverings which will give temporary service, but a roofing material which will not disintegrate under the destructive action of the elements and yet be economical in cost and present an artistic appearance has been a long felt want.

The ever increasing and varying uses to which concrete is adapted has proven that it is the ideal building material for every purpose. Its superiority and advantages are being realized more and more fully every day. It is recognized as the only building material that does not deteriorate with age and exposure, but, on the contrary, increases in strength and thereby proves its indestructibility.

A company recently organized in Indianapolis has placed upon the market a roofing tile machine, protected by United States patents, which is a very practical machine, by which this ideal building material can be manufactured into roofing tile which are fireproof, storm-proof, water-proof, indestructible, and which can be put on more easily than shingles.

A plant for the manufacture of concrete roofing tile will soon be in operation in Fort Wayne, Ind., according to the Fort Wayne Daily Journal, which recently published the following item: "This city has acquired a new industry by the recent formation of the Fort Wayne Concretile Company, which plans to manufacture and market in this vicinity a roofing product known as 'Walter Concretile,' which is destined to change the skyline in Fort Wayne, if the success of similar companies in other sections is a criterion.

"'Walter Concretile' is made of concrete in tile shapes, which, when laid on the roof, produce a finish which has been declared by those who have seen this roof elsewhere as lending a character and beauty to buildings which cannot be surpassed.

"Statistics show that upwards of 60 per cent of the fires in our American cities occur because of the inflammable character of the building roofs, and numerous attempts have been made to obtain a suitable roofing which would reduce this enormous fire hazard.

"The few really fire-proof roofs on the market heretofore have been almost prohibitive except in the most expensive buildings, due to their excessive cost, not only on account of the price of the material itself, but because of the weight of the roof, which necessitated extra and costly roof construction.

"The 'Walter Concretile' which the new Fort Wayne Concretile Company will manufacture and market combines within itself absolutely fire-proofness; durability which age and the buffeting of the elements cannot affect; a beauty which is appreciated by all; and also it is sufficiently light in weight not to require expensive roof construction for its support. This concretile, which makes literally a 'stone roof,' can be easily laid on any roof, ranging from a bungalow to the most elaborate building.

"The Fort Wayne Concretile Company believes that in a short time its roofing product will be seen on all kinds of buildings in this city and vicinity, as 'Walter Concretile' is indorsed by fire insurance underwriters, fire chiefs, architects, engineers, builders and owners. The company has acquired a site for its factory in Fort Wayne and will immediately commence the erection of a plant wherein a number of machines and other necessary equipment will be installed, so that a quantity of roofing will be in stock when the summer building season opens.

"The Fort Wayne Concretile Company is incorporated for $25,000, with the following directors:

"W. E. Woebbeking, Charles V. Jacobs, Edmund A. Bittler, Robert Millard, C. P. Milliken, Clinton R. Willson and E. C. Miller.

"Mr. Milliken is president of the company; Mr. Bittler vice-president, and Mr. Miller secretary and treasurer. Three locations for a plant are being considered and one of them will be selected at the next meeting of the directors.

"Concretile is a newly coined word resulting from the combination of the words 'concrete' and 'tile' and has been copyrighted by the Walter Concrete Machinery Company and licensed only for use in connection with the roofing product manufactured on machines sold by the Walter Concrete Machinery Company. This company controls patents on the machine and process of manufacture of the roofing tile.

"The incorporators of the new Fort Wayne company are enthusiastic in having acquired the rights for the manufacture of 'Walter Concretile' in this section of Indiana, and they intend to make this roof the standard fire-proof roof in Fort Wayne as it has become elsewhere."

PAPER CONSERVATION

We have just received a house organ, "Paragrafs," issued by Smith, Dixon Company, division the Whitaker Paper Co., Baltimore, Maryland, containing an article, "The World Confronting a Paper Famine—Why Prices Must Go Higher."

In this article statements are made as follows:.

"But cellulose is also the basis of modern high explosives.

"The Du Pont Powder Mills have installed an enormous battery of beaters having a capacity vastly greater than the capacity of any paper mill in the United States. They are paying fabulous prices for rag stock and commanding the first choice of rags from all over the country.

"What in normal times would be the fibrous texture of fine papers is now being converted into ammunition for bomb and torpedo and howitzer and machine gun."

It is the publication of incorrect statements like this that causes panic. We do not make explosives from paper stock. We make gun cotton from cotton, and smokeless powder is made from gun cotton. We also manufacture soluble cotton having lower degree of nitration than gun cotton, and not explosive, for use in the manufacture of Fabrikoid and the pyroxylin solutions sold by the Du Pont Chemical Works.

The Arlington Company of Arlington, N. J., which we own, manufactures pyralin, a product of the nature of celluloid, and which is made from nitrated rag stock. The Arlington Company recently bought a paper mill in Norwich, Conn., having eight beaters; two new beaters are being installed, designed to replace two of the original eight. The Arlington Company recently bought a supply of rag stock for which higher prices were paid than formerly, but neither the amount bought nor the prices paid were such as to create more than slight and temporary flurry in the rag market.

Now as to the conservation of paper: The solution of this problem is largely in the hands of advertisers and business houses in general. For instance, we had a plan to double the size of our house organ with a circulation of 200,000 per month, but have decided to suspend this matter for the present rather than to further disturb the paper market. We will also, until the situation is relieved, publish every other month instead of every month.

All our offices will be immediately supplied with half-size letterheads to be used for short letters.

We will do no circularizing not absolutely necessary.

In every other way that will not seriously interfere with our business, we will make an earnest effort to conserve paper.

If every member of the Association of National Advertisers will adopt the same policy, we are confident that relief will be immediate and prices will again become normal or nearly so.

One more important point is to see that all waste paper is resold rather than burned. Our advertising department has a regular monthly income from the sale of old paper and obsolete electrotypes, half-tones and line cuts. If every advertising manager will look over his stock of cuts and sell the metal of those that are no longer needed, it will help the metal market and will help prevent prices of cuts and electrotypes from going higher.

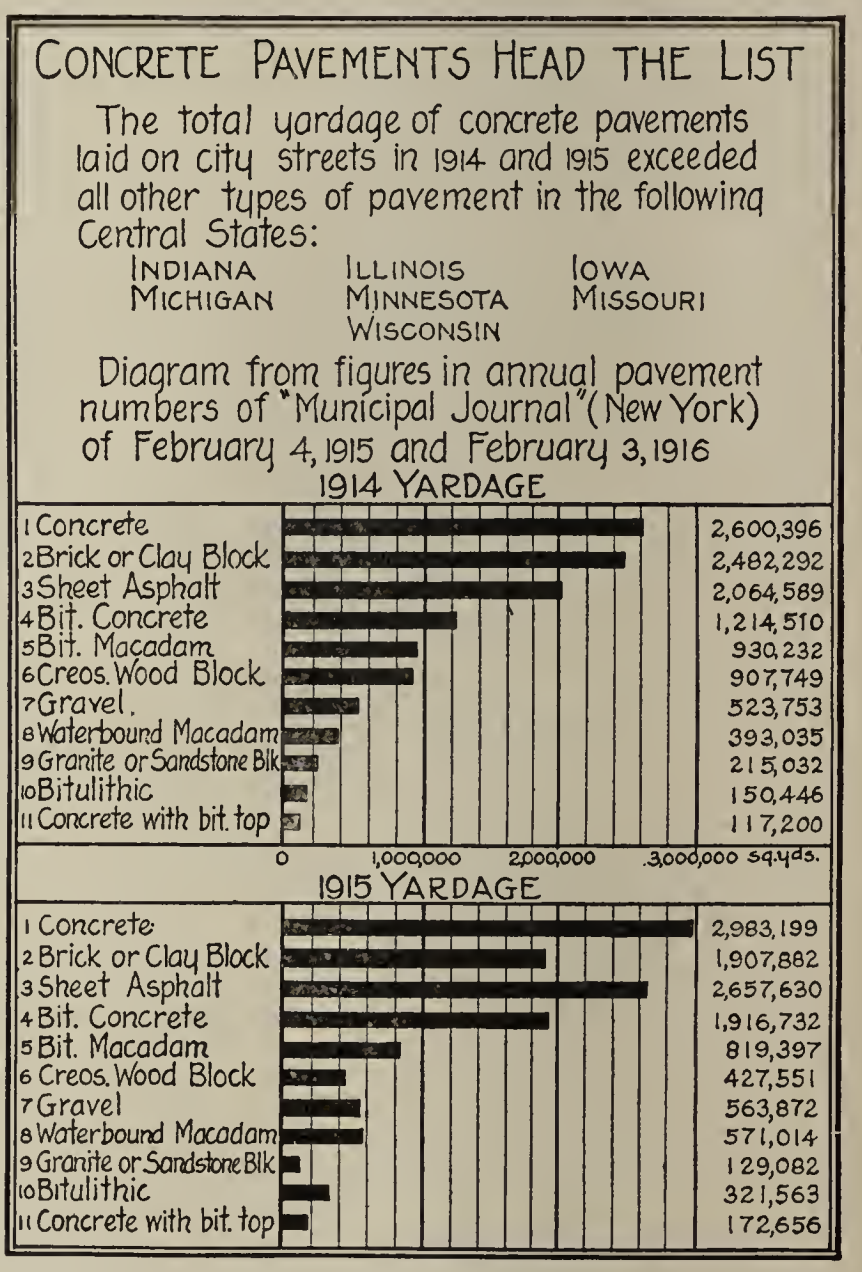
Very truly yours,

GEORGE FRANK LORD,
Manager Advertising Division,
Du Pont Powder Company, Wilmington, Del.

COST OF CEMENT ROADS BY STATES

The average cost per square yard of constructing concrete roads, reported to the Association of American Portland Cement Manufacturers in 1913 and 1915. The figures for 1915 gathered by association's inspectors:

	1913	1915
Connecticut	$1.32	$1.13
Illinois	1.01	1.03
Indiana	1.23	0.98
Iowa	1.11	1.19
Kansas	1.08	1.28
Maryland	1.21	1.08
Massachusetts	1.29	0.95
Michigan	1.27	1.10
Minnesota	1.05	1.11
Missouri	1.17	1.09
New Jersey	1.12	1.23
New York	...	0.98
Ohio	1.22	1.02
Pennsylvania	1.16	1.01
Texas	...	1.15
West Virginia	1.32	1.03
Wisconsin	1.06	1.02


CONCRETE PAVEMENTS HEAD THE LIST
The total yardage of concrete pavements laid on city streets in 1914 and 1915 exceeded all other types of pavement in the following Central States:
INDIANA
ILLINOIS
IOWA
MICHIGAN
MINNESOTA
MISSOURI
WISCONSIN
Diagram from figures in annual pavement numbers of "Municipal Journal" (New York) of February 4, 1915 and February 3, 1916
1914 YARDAGE
1 Concrete 2,600,396
2 Brick or Clay Block 2,482,292
3 Sheet Asphalt 2,064,589
4 Bit. Concrete 1,214,510
5 Bit. Macadam 930,232
6 Creos. Wood Block 907,749
7 Gravel 523,753
8 Waterbound Macadam 393,035
9 Granite or Sandstone Blk 215,032
10 Bitulithic 150,446
11 Concrete with bit. top 117,200
0
1,000,000
2,000,000
3,000,000 sq.yds.
1915 YARDAGE
1 Concrete 2,983,199
2 Brick or Clay Block 1,907,882
3 Sheet Asphalt 2,657,630
4 Bit. Concrete 1,916,732
5 Bit. Macadam 819,397
6 Creos. Wood Block 427,551
7 Gravel 563,872
8 Waterbound Macadam 571,014
9 Granite or Sandstone Blk 129,082
10 Bitulithic 321,563
11 Concrete with bit. top 172,656

HAVE INSTALLED A LARGE CRUSHER

The new Gates gyratory crusher which the Universal Granite Company, 208 South La Salle street, Chicago, purchased from Allis-Chalmers Manufacturing Company several months ago, is now in operation at their plant in Lohrville, Wis., turning out 40 cars of crushed granite per day, or 1,200 cubic yards. The company also purchased from Allis-Chalmers Manufacturing Company new screens. They also use two No. 2 and a No. 4 Gates crusher, two Link-Belt locomotive cranes equipped with Kiesler clam-shell buckets, one dinky locomotive and Western 3-yard dump cars. They have their own electric light plant.

CONCRETE FLOORS IN DWELLING HOUSES

By Homer Laughlin, Jr.

To give you accurately my experience in living in a house with concrete floors, it will perhaps be well to go back a little way and relate my experiences which led to the adoption of a concrete floor for a residence.

The Homer Laughlin building, Los Angeles, which I own, was built in 1898 and was the fifth building in the United States and the first building west of Chicago to use concrete floors. These were concrete floors placed on a steel skeleton. At the time the building was opened I had grave doubts of its success because every prospective tenant brought up the subject of the floors. Either they themselves were affected by rheumatism or they had some one in their office who had rheumatism and they were quite sure that living in an office with concrete floors would be detrimental to their health. The common remark was that they could feel the chill of the concrete go through them the moment their shoes touched the floor. Although the prejudice was gradually overcome it was at least five years, when concrete floors in office buildings had become more general, before the attention of the public was attracted to other features and away from the concrete floors, and I may safely say that it has been at least three years since I have heard a single person mention the subject.

When I was about to erect my home and decide on the subject of floors, my father, who had been a strong advocate of concrete floors in office buildings, advised me against their use in a residence. Careful inquiry developed that he himself was not opposed to the floors but was satisfied that my friends and others would interpose all the objections to their use in a residence that we had formerly gone through in our office building, and so I decided to put wooden floors downstairs for the benefit of my friends and concrete floors upstairs for the use of my family; but finally we worked up one excuse after another for leaving the wood floors out of certain downstairs rooms and finally they were left out altogether.

My floors are of a warm brown tone and come up on the side walls about 6 inches and flush with the plaster to form what would otherwise be a baseboard. Downstairs they are decorated with a pallette-knife and look somewhat like carved leather. After the "carving" had been done an artist worked various colors of the rainbow into the decoration and then they were all varnished and waxed so that keeping them in order is similar to the polishing of wood floors but the polishing is required much less frequently.

Upstairs we use velvet carpets of double width and plain colors, sewed together to form a mat or rug, but without a border, and extending within 6 inches or 8 inches of the side walls all the way around. We find that no nailing strips or other means of fastening are necessary, since the carpet lies perfectly flat and is sufficiently large so that it will not move about.

Downstairs we use Oriental rugs entirely and a curious feature in this respect is that moths will not hatch on the under side of a rug in contact with concrete, where they do hatch when it is in contact with wood. This applies to the under side of the rug only, because it is not impossible for them to hatch within the rug fabric itself.

Now, the common impression is that a concrete floor will make the room cold, but this impression is reached by people who have gone into rooms with concrete floors where there was no carpet on the floor and because at the moment, they were critical of concrete, but if one will go into a bare room where hard wood floors have been used they will get exactly the same effect. The addition of carpets and tapestries decreases the number of square feet where the air of the rooms comes in contact directly with the floor or side walls.

There is also an impression that concrete floors are damp. They are damp for the first two months after being laid and on this account should not be varnished or waxed; but after this period they are as dry as wooden floors. I have made accurate tests with hygrometers, to determine this point.

The concrete floor is to me most satisfactory because it is free from cracks in which dust accumulates and ascends every time the floor is flexed by stepping on it. There is never a squeak or other noise produced by the rubbing of one board of the interior floor on another. With carpets on the floors they are absolutely noiseless, and one cannot detect a person walking on an upper floor when he is in the room below, provided, of course, that there is a carpet on the floor above.

The concrete floor makes a much handsomer setting and background for Oriental rugs than wooden floors and one can do away with the unsightly baseboard, which always collects dust. Then there is none of the trouble of warping and straining which comes with the use of wooden floors.

Above all else the house is fireproof when properly built in other respects and one can leave home with the assurance that neither property of any considerable value nor lives will be destroyed in the event of fire. I feel that my pictures, rugs and porcelains are as safe in my house as in a vault at the bank, barring the possibility of theft, which is rather remote.—[Concrete-Cement Age.]

AMERICAN CONCRETE INSTITUTE CONVENTION

The twelfth annual convention of the American Concrete Institute was held in Chicago, February 14 to 17 inclusive. The convention was well attended and many papers of interest were presented, although the program was too crowded to permit the full discussion which some of the papers merited. As in the past, the program of the convention was devoted largely to matters of direct interest to highway building and municipal engineers, only one paper by C. W. Simpson, resident engineer, Delaware, Lackawanna & Western, on the organization and conduct of the construction work on the Tunkhannock and Martin's Creek viaducts, being devoted to a strictly railroad subject.

A paper by W. K. Hatt, professor of civil engineering, Purdue University, entitled, "Genesis of Reinforced Concrete Construction," recounted the work of the pioneers in this field, in France, Germany and America, and was probably the most interesting paper presented at the convention from the standpoint of the student of reinforced concrete design. A paper entitled "The Chemistry of Portland Cement," by George A. Rankin, Geophysical laboratory, Carnegie Institution, Washington, D. C., gave a lucid treatment of a highly technical subject.

Sands and gravels received considerable attention. Besides the paper on gravel specifications by Mr. C. C. Brown, four papers and committee reports were devoted to this subject. Duff A. Abrams, professor in charge of laboratory, Lewis Institute, Chicago, gave a synopsis of a paper in preparation, concerning the tests of 885 sands made at the Special Materials research laboratory, which are the basis of his "Modulus of Fineness" proposed as an index of the strength of a mortar to be made with a given sand.

Lehigh District Makes Third of Nations Cement

Twenty-two Great Plants Make the Lehigh Valley the Greatest Cement District in the World.

Almost thirty per cent of all the cement manufactured in the United States is made in the Lehigh Valley, eastern Pennsylvania, in its twenty-two mills. Among cement men and geologists it is known as the "Lehigh District."

During the year 1914 in this district 24,968,554 barrels were produced with a value, according to government figures, of approximately $23,000,000.

This product has supplied not only the large territory of the eastern states but millions of barrels have gone into export trade.

Lehigh cement has made the Panama Canal possible. The great Galveston levee is largely made of Lehigh district cement. The New York Subway is largely Lehigh district cement. Practically all the great irrigation systems, with their dams and other extensive engineering work, are the product in large measure of Lehigh district cement.

New York's skyscraper section was built up largely out of the Lehigh district, steel and iron from this section furnishing the bony framework and the cement district furnishing the great massive bodies of the buildings in that section.

The size of the mills in the Lehigh district can be imagined when it is known that it has twenty per cent of the mills of the country but manufactures more than thirty per cent of the product.

In the effort to secure South American trade, now opening up strongly, the Lehigh region has unusual advantages, being within sixty miles of tidewater at Philadelphia, within a hundred at New York, and with excellent transportation service by rail or water.

Allentown Industry's Center

Cement is one of the staple products of the Lehigh Valley, for which Allentown is the logical center. It has become one of the greatest industries in this section. Millions are invested in the plants and the number of employes is about 10,000. The products mount up into the millions and they find a ready market both in this country and abroad.

The Lehigh District

What is known as the Lehigh district is comprised of New Jersey and Eastern Pennsylvania. The cement rock is found in a restricted area, like the arc of a circle, extending from Evansville in Berks county on the west through Lehigh and Northampton counties to and into Warren county in New Jersey, as far east as New Village, N. J. Herein are embraced all the cement mills of the Lehigh region, 22 in number, with an output in 1913 of 26,659,537 barrels and in 1914 24,968,554 barrels. These plants in Lehigh county are located at Fogelsville, Ormrod, Egypt, West Coplay, Coplay and Cementon. In Northampton county they are at Northampton, Bath, Nazareth, Stockertown and Martins Creek. The plans in New Jersey are at Alpha, Vulcanite and New Village. Their location so close to the seaboard and with unsurpassed shipping facilities has made these mills in great demand for cement for transportation abroad and along the sea coast. They also supply the bulk of the cement for the largest contracts in the large cities on the sea coast, for sewers, subways, bridges, skyscrapers and other construction.

The total value of the Portland cement shipped from this district in 1914 was reported to be $19,401,780, at an average price of 80.9 cents a barrel in bulk at the mills, as compared with $22,342,102, or 83.8 cents a barrel in 1913.

Steady Production Increase

The Lehigh district has, except in five years, shown a steady increase in production of Portland cement from 1890 to the present time. The years prior to 1914 in which slight decreases were recorded are 1893, 1908, 1911 and 1912. The first two decreases were coincident with years of general business depression, but the decrease in 1911 and 1912 may perhaps be attributed to an overproduction in 1910 and to the building of many mills in other parts of the United States, which have restricted the trade territory of the Lehigh district. Because of the discovery of cement elsewhere the percentage of the production in the Lehigh region as compared with the total output of the United States is steadily decreasing. The percentage has been as high as 74.8 per cent in 1897. Last year it was 27.9. Yet the production of 1897 was only 2,002,059 barrels and in 1914 24,614,933 barrels.

In the table below is the output in barrels of the Lehigh region during the past quarter century:

	Barrels		Barrels
1890	201,000	1903	12,324,922
1891	248,500	1904	14,211,039
1892	280,840	1905	17,368,687
1893	265,317	1906	22,784,613
1894	485,329	1907	24,417,686
1895	634,276	1908	20,200,387
1896	1,048,154	1909	24,246,706
1897	2,002,059	1910	26,315,359
1898	2,674,304	1911	25,972,108
1899	4,110,132	1912	24,762,083
1900	6,153,629	1913	27,139,601
1901	8,505,340	1914	24,614,933
1902	10,829,922		

State Big User of Article

It is estimated that the consumption of cement per capita in the United States is .79, while the estimate for the state of Pennsylvania is .87.

Value of Cement Output

The secretary of internal affairs of the state of Pennsylvania in his report for 1912 gives the reports of 24 establishments in the manufacture of cement in this state. The capital invested was reported as $43,337,190; total production, 26,663,008 barrels of a value of $19,587,318; average number of days in operation, 299; average working hours in the industry per week, 90; average number of employes as managers and office help, 538; salaries paid, $706,409; average number of wage earners employed, 8,867; aggregate amount of wages paid, $4,791,662; nationality of employes: Americans, 2,992; foreigners, 5,551; negroes, 28. The most noteworthy feature of the reports for 1912 was the general shortage or scarcity of labor, which curtailed the production of some of the plants and caused increase of wages as much as 15 per cent. One manufacturer deplored the fact that there was so much legislation upon industrial matters and thought it was on account of having too many lawyers in Congress.

History of Cement in Lehigh

While the first cement rock was discovered in the United States in 1818, the discovery in the Lehigh Valley was not made until 1826 at Lehigh Gap during the building of the Lehigh Canal. The first cement opera-

tion was put into effect at the gap near Craig's hotel, where four kilns were set up, from ten to fifteen feet in height, to which the rock was hauled a distance of six miles from the ridge above Palmerton. The rock became exhausted here in 1830 and the kilns were destroyed by the flood in 1841.

First Mill at Seigfried

While constructing the canal at Siegfried another deposit of cement rock was uncovered in 1830 and Samuel Glace, a supervisor for the canal and a resident of Catasauqua from 1841 to 1892, built four kilns with a daily capacity of ten barrels and which he operated until 1841. Messrs. Menninger, Kohl, Eckert and Ackerman operated the plant until it was sold to the Lawrence Cement Co., and it was then abandoned. The ruins of the kilns are still to be seen along the river bank.

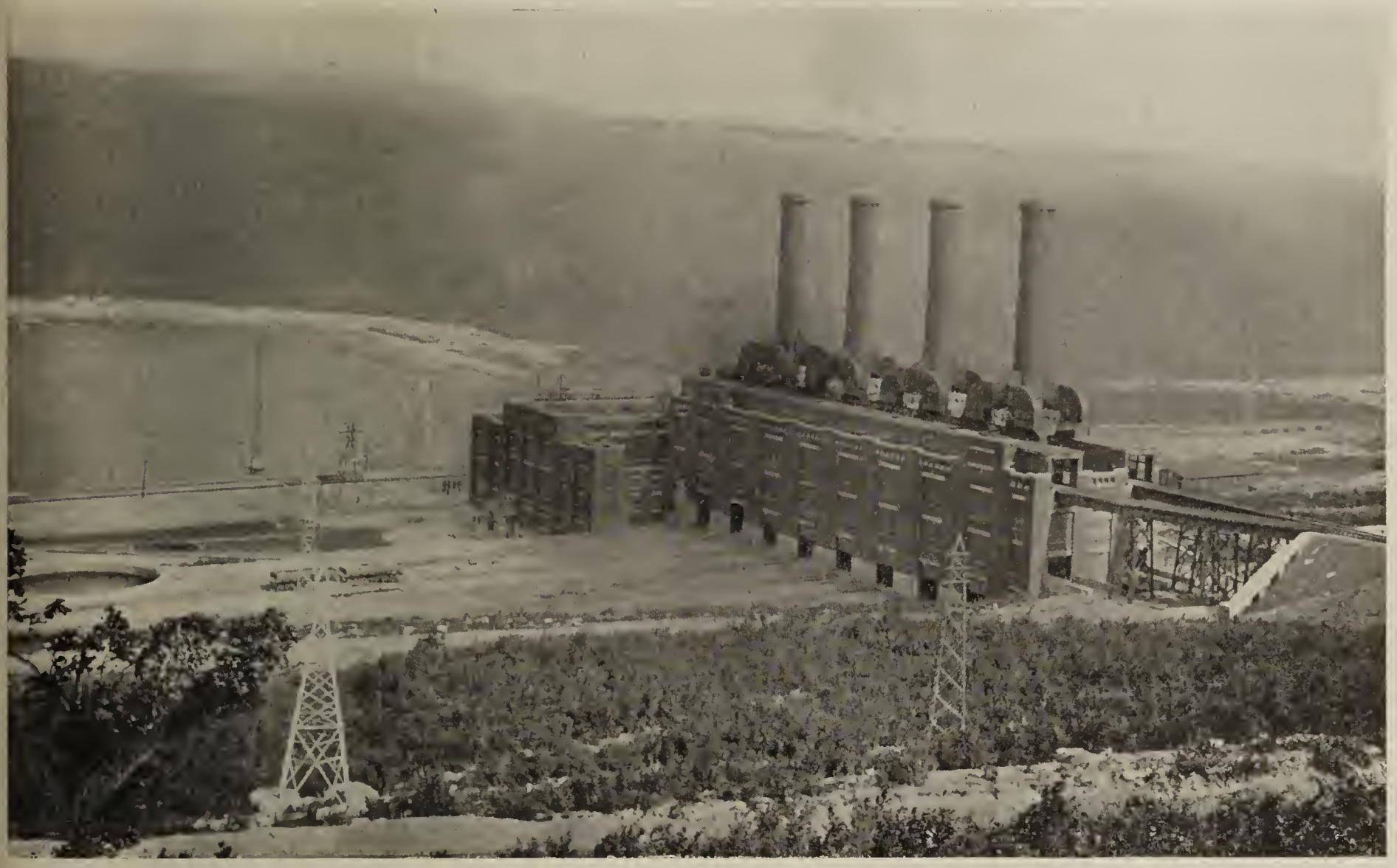
First Big Company

In the making of excavations for the Lehigh Valley Railroad along the west bank of the river at Coplay an extensive formation of cement rock was uncovered. The value of the rock was discovered by David O. Saylor, who made experiments, and, with Adam Woolever and Esaias Rehrig, organized the Coplay Cement Co. in 1866, the pioneer of the industry. They built two small kilns and fitted out an old distillery as a grinding mill, This was the real genesis of the huge cement industry of the Lehigh region.

Other plants also sprang up in this district, and the manufacture of cement was revolutionized by the application of the rotary kilns. The latest addition to the improvements in the manufacture of cement is the application of electric power, which is brought from the plant of the Lehigh Navigation Electric Co.

This plant is located in the coal fields at Hauto, Pa., and has been specially designed with boiler equipment for using low-grade coal taken from near-by culm banks. The initial installation consists of three 16,000 H. P. turbines and generators, one of which is held as a "spare" to insure continuous service. The transmission lines are of an extra heavy design, are arranged with duplicate circuits, and are patrolled daily in order to locate and repair faults before trouble occurs. The service required by the cement industry is most exacting, as power is required every day and night and a shut-down means a serious loss. This company is now supplying for the cement industry alone a total of approximately 15,000 H. P.

Cement mills were also erected at Wellington north of Coplay and at North Coplay, but these are no longer in existence. The American, now the Giant plant at Egypt, came into existence in 1885; the Lehigh Portland in 1897 and the Whitehall later. These plants are all in active operation, and they rank with the best and largest in the country. Across the river in Northampton county are other plants extending from the Lehigh to the Delaware river, being erected and operated where the cement rock is in abundance. As the supply is seemingly inexhaustible, the industry is certain to be permanent.



Lehigh Navigation Electric Company Power Plant at Hauto, Pa., which is supplying electric power for the manufacture of approximately 500,000 barrels of cement per month in the Lehigh and Nazareth districts.

B. E. MILLER APPOINTED PLANT MANAGER BY ATLAS CEMENT COMPANY

Beginning the first of the year B. E. Miller was appointed by the Atlas Portland Cement Co. as plant manager of their Hudson, N. Y., plant succeeding W. A. Pollock. Mr. Pollock, who after several years' service with the Atlas, resigned to take a responsible position with a large coal company operating in the Lehigh Valley.

Mr. Miller had been assistant plant manager at Hudson for several years and has a wide experience in the cement business.

CEMENT AND ENGINEERING NEWS

(PUBLISHED MONTHLY)

WILLIAM SEAFERT, Editor and Publisher

Office—672 Transportation Building, Chicago

Telephone, Harrison 5397 Cable Address, "Seaferts" Chicago

Entered at the Post Offfce at Chicago, as second-class matter, July 21, 1896 under Act of March 3, 1879

SUBSCRIPTION RATES:

United States, Canada, Philippine Islands and Mexico, two years for $1.00; all other countries, $1.00 per year.

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CHICAGO, JUNE, 1916

NECESSITY FOR EXPORT TRADE IN THE CEMENT INDUSTRY

A significant feature of the cement industry is the fact that though only about 80 per cent of the normal cement producing capacity of the country is employed at the maximum, there is often an overproduction. Yet the exports of cement have scarcely exceeded 4,200,000 barrels in any one year, this amount being only about 5 per cent of the total output—not sufficient to take care of the surplus production in a year of great activity.

There are excellent reasons for stimulating the export trade in cement as rapidly as possible, for, although the export of a relatively bulky and low priced material such as cement does not promise large direct profits to an individual producer, indirectly the creation and maintenance of an export trade should benefit the industry at large through the opportunity afforded of disposing of the surplus stocks, thereby tending to maintain steadier prices.

Opportunity in South America

American manufacturers have not yet made the most of their opportunities to establish greater export trade. France has exported 23 and Germany 17 per cent of their total production. There are few cement mills in South or Central American countries, and in the past these countries have been getting their cement from Europe. This source is now shut off because of the war and there is evidently an opportunity for the American manufacturers to secure this trade.

Some of the Lehigh region and southern cement manufacturers are already cultivating trade relations with South American and Central American markets, and important shipments have been made recently from southern plants to South America.

Boosting Cement in Spanish

In order to acquaint builders of South America with the character and possible uses of its white cement, the Sandusky Cement Company has issued a booklet in Spanish, describing and illustrating its product. It seems to be generally acknowledged that there are several serious problems which must be solved before the cement producers of the United States can permanently annex the South American markets. Education of the cement user to a full appreciation of the superiority of the American cement over others is one of the first steps. The question of bagging is another. The foreign manufacturers shipped the cement in barrels and we, too, must get some kind of durable package in which to ship the cement. An oil-cloth sack has been suggested.

Need of Merchant Marine

Another obstacle to steady export trade with South America is the lack of ships engaged in the carrying trade, especially with Brazil and Argentine. A better basis of exchange of commodities between North America and South America through American banking houses is needed in order that trade may be expanded. South American traders have been granted long-term credit by European manufacturers and these conditions must also be conceded by us.

In 1914 the total quantity of cement exported to foreign countries, including the Philippines and the Panama Canal Zone, was only 2,140,197 barrels, valued at $3,088,809. In the year before the exports were 2,964,358 barrels, valued at $4,270,666.

IMPORTS AND EXPORTS OF CEMENT DURING MARCH, 1916

Imports

Districts	100 lbs.	Dollars
New York	749	435
Laredo	12	20
Total	761	455

Domestic Exports

Countries	Barrels	Dollars
England	1,000	1,450
Berumda	1,026	1,440
Canada	760	1,139
Costa Rica	2,400	3,437
Guatemala	1,750	2,829
Honduras	712	1,121
Nicaragua	977	1,692
Panama	63,098	69,108
Salvador	3,276	6,063
Mexico	12,977	21,643
Jamaica	5,475	7,603
Trinidad	4,001	5,572
British West Indies (other)	1,919	2,720
Cuba	98,127	140,312
Dutch West Indies	825	965
French West Indies	2,945	4,505
Haiti	1,215	1,782
Santo Domingo	4,651	6,840
Argentina	2,720	3,877
Brazil	23,162	28,612
Colombia	7,102	9,963
Ecuador	2,225	3,711
British Guiana	250	362
Peru	1,678	2,382
Venezuela	2,328	3,144
Other countries	2,096	2,704
Total	248,695	334,976

CONCRETE ROAD

The contract for the construction of 2,600 linear feet of concrete road in North Andover, Mass., has been awarded by the State Highway Commission, Boston, Mass., to B. Perini, Ashland, at $7,544.

THE WILSON AVENUE TUNNEL

A Mammoth Chicago Enterprise Which Has Been Conducted With Commendable Economy by the City Engineers

Three tons and a half of dynamite have been exploded every day for more than a year on a single job in Chicago, and not one person in a thousand can guess where, says Mr. Hyde in the Tribune.

The reason all this bombardment has occurred and is going on daily without the knowledge of the public is that these thousands of tons of dynamite have been set off down 160 feet under the level of the ground.

No Serious Damage Done

The plastering has been cracked on the sitting room ceilings of a few adjacent houses and a considerable number of panes of glass have been shattered. But no serious damage has been done. And in all the work of placing and firing the charge of high explosives not a workman has been injured.

It is some job—this blasting of a 12-foot tunnel through nearly eight miles of solid rock. Even now few people will have the least idea what is referred to.

It was in the summer of 1914 that the city council opened bids for the construction of what has come to be called the Wilson avenue water tunnel, the main drift of which runs from the village of Mayfair to the new crib and intake located more than three miles out in Lake Michigan. Putting all the figures together, it appeared that the lowest offer was about $65 for every lineal foot of the more than seven and a half miles of bore.

Do Job by Day Labor

After considering the bids it was decided to undertake the big job by day labor, under the direction of the engineering department of the city. That was under the administration of Mayor Harrison.

Now any critic of democratic institutions, and particularly of American municipal government, will tell you that to turn a big job over to be done by public officials is to make sure that it will be done in the most expensive, reckless, and altogether extravagant way possible. Which is the chief reason why this story is worth telling.

Up to January 1, 1916, considerably more than five miles of the total length of the tunnel had been completed. And the cost has been $55 a lineal foot As opposed to the lowest price quoted when bids were asked from private contractors, the saving to the public treasury is $267,000. The man in direct charge of the work—under the direction of the city engineer—is the chief of the construction division, Henry W. Clausen.

Save Year's Time

The direct money saving is not the only or the greatest saving to be set down to the credit of the public servants who are in charge of and doing the work on the tunnel.

Engineers estimated that it would take forty-two months from the time of commencement to complete the most important section of the tunnel. So fast have the city forces done their work that it will be entirely finished within thirty months of its start, a saving of a full year.

Hitherto, when tunnels have been blasted through solid rock, the resulting spoil has been carried to the mouth of the shaft and then lifted to the surface of the ground. Later, when the hole through the rock was completed and it came time to put a lining of concrete in the bore, gravel or crushed stone has been lowered and mixed with the cement.

Develop New Method

In the present job the city engineer determined to lift to the top only such part of the blasted rock as would not be later needed for the concrete mixture. They kept enough in the tunnel to serve that purpose and, with the aid of portable screens, sorted out the desired size and quantity of crushed stone for the concrete mixer. As a result the lining has been put in as the work progressed, with a considerable saving in both time and expense.

When the first borings were made in preparation for boring the tunnel, it was found that the top layer of the ground was composed of quicksand and other unstable materials. Below that was a thick layer of blue clay. Still lower came the solid limestone. In order to make a tunnel that would be free from danger of leaks and of possible accidents, it was decided to go down well into the stone. That is why the bore is being blasted through the solid rock at a depth of 160 feet.

Improve on Crib Design

The city engineer's office is also responsible for an entirely new design of crib, which has been used in the present instance with complete success. The crib is the little cabin which stands far out in the lake at the terminus of the water tunnel. Hitherto a heavy construction with a floor of huge timbers has been towed out into the lake and sunk at the desired location. For the Wilson avenue crib the city engineers designed two big cylinders of iron, one ninety feet in diameter, the other much smaller. The bottom of each cylinder was fitted with a sharp cutting edge. They were sunk, one inside the other, and by their own weight cut their way securely down into the bottom of the lake. After the intake pipes for the water and the other necessary attachments were arranged, the remainder of the space between the two iron cylinders was filled in with broken rock and concrete. The result is a perfectly dry and solid foundation for the crib.

When the new tunnel is completed it will furnish a supply of 350,000,000 gallons of water per day for the city of Chicago.

If that was the sole supply of the people of Chicago they would get as much water per capita as most of the benighted inhabitants of Europe enjoy. As a matter of fact, Chicago is now pumping more than twice as much water daily.

SAND AND GRAVEL RATES ADJUSTED.

The following is the decision of the Railroad Commission adjusting the rates on sand and gravel in and around Waco over which there has been extended controversy:

Amend Item 12, Section 3 of Tariff, by canceling Paragraph (a) thereof and substituting therefor the following:

"(a) Sand and gravel, in carloads, from Texand to locations on San Antonio & Arkansas Pass tracks in Waco, $5 per car. When deliveries in Waco are on tracks of other lines, regular switching charges for the distance handled by such other lines shall be added to the charge of $5. This rate not to be used as a division or basis for division on shipments going beyond Waco.

"(b) On sand and gravel, in carloads, from Texand to points in Texas (other than Waco), the rate to be applied shall be that applicable, to the same commodity, from Waco to the same point of destination; except that where the point of destination is a non-competitive point, the rate to be applied from Texand shall be the Waco rate plus $1 per car."

Effective June 1, 1916.

A Modern Hydrated Lime Plant

By Richard K. Meade, Engineer, Baltimore.

One of the newest hydrated lime plants is that of the Dutchess County Lime Company, at Dover Plains, N. Y. This plant was completed in the fall and has now been in operation for about four months. This company, however, has been in existence for several years, operating two small kilns about two miles from the town of Dover Plains, hauling their lime to the railroad with teams and bringing the coal and other supplies to the plant by the same means.

The stone found on the property is a high-grade magnesian limestone of which the following analyses give a good idea.

Analyses of Limestone.	From old quarry	From new quarry
Silica	0.74	0.88
Iron oxide and alumina	0.92	0.90
Lime	31.04	30.74
Magnesia	21.03	21.11
Loss on ignition	46.34	46.64

The lime has been sold for years in New York City, Albany, Poughkeepsie and other cities along the line of the New York Central R. R. and enjoys the reputation of being a very high-class building lime. About two years ago the company decided to build a new plant consisting of both kilns and hydrating equipment and commissioned the writer to prepare plans and specifications for this plant. It was decided also to locate the plant on a part of the property adjacent to the railroad, where the same quality of stone as at the old plant is found and to extend a siding from the railroad to the plant. At the new site, the stone lies to the south of the plant in a hill, having quite a considerable elevation, while an ideal location for the mill was found on a level plateau immediately adjacent to the hill and easily reached from the railroad. Work was begun upon the plant in winter and completed in the late summer of 1914.

Fig. 1. Plant of the Dutchess County Lime Co. Capacity 30 tons of hydrate in 10 hrs. It is equipped with a Sturtevant crusher, a Clyde hydrator, the Raymond air system and Urschel-Bates sackers. There is also a Fuller mill for furnishing pulverized limestone for farm purposes and for grinding up the tailings which are sold for the same use.

Fig. 2. Lime Kilns During Construction.

The general layout of the plant is shown in Fig. 1. The kilns are located at the end nearest the quarry; next comes the cooperage and barrelling department, then the boiler room and the hydrating plant in the order named and finally a storage for hydrated lime, which latter is not yet completed.

The kiln building is designed to receive five kilns, two of which are already in place. These kilns are of the general type found throughout Maryland and Southern Pennsylvania (Fig. 2). They have been modified, however, so as to obtain both increased output and economy over the latter. The kilns are equipped with two fire boxes, one on each side, and a cooling cone below. They also have a storage for stone in the upper part of the kiln. The capacity of the kilns on the stone found at Dover Plains will average about 12 tons per day. The fuel ratio is about 1 of coal to 4 of lime.

Arrangements have been made to install a belt conveyor to carry the lime from the kilns to the hydrating plant, but at the present time the lime will be wheeled from one to the other.

On entering the hydrating plant, the lime is first passed through a Sturtevant open-door crusher (see Figs. 3 and 4). This reduces the lime to such a size that it will all pass through a one-half inch screen, which is fine enough for hydrating purposes. From the crusher the lime is elevated to the third and top floor of the building into a large steel bin which holds

about 20 tons of lime and is provided at the bottom with a spout and gate, the latter being opened and closed by a lever. Below the spout is located the weighing hopper and beneath this, the Clyde hydrator (Fig. 5), which rests on the second floor: the scale box and indicator to the water tank are also on this floor, so that all the operations of the hydrator are controlled at one point. The lime is weighed out in batches of 200 lbs. and dumped directly from the scale hopper into the hydrator. The water is measured in a tank beside the lime bin and is sprayed on the lime after the latter is introduced into the hydrator. The process of hydration lasts about 20 minutes, although it is probable that when the plant is pushed for capacity this time can be shortened to 15 minutes, as this lime hydrates very rapidly—particularly so for a magnesian lime.

After passing through the hydrator, the lime is dumped into a large steel bin or hopper, capable of holding comfortably the charge from the hydrator, and provided at the bottom with an automatic feeder which serves to regulate the supply of lime going from the hydrator to the pulverizer and is so adjusted as to empty the hopper before the new charge from the hydrator is ready to be dumped. The lime falls from the feeder into a screw conveyor which carries it to the pulverizer.

For treatment of the lime after passing through the hydrator, the Raymond system is used. The lime first goes to a No. 1 automatic Raymond pulverizer (Fig. 6), located on the ground floor; this mill is equipped with a throwout which separates from the hydrate any large pieces of core or unhydrated lime left in the product of the hydrator. From the pulverizer the fine product is sucked up by means of a No. 11 fan, and blown into a 7-ft. dust collector located above the packing bin, as shown in Fig. 3.

It will be noticed that for the hydrating part of this plant only one elevator is used, namely that for carrying the lime from the crusher to the lime bin. This is a feature of all the plants which the writer has designed, thus greatly simplifying the installation.

In connection with the cyclone dust collector there is also a tubular collector with 18-ft. tubes. This is designed to catch the dust in the exhaust from the Raymond system. The product obtained from this is so fine that all of it will pass a 100-mesh screen, and on account of this extreme fineness, it is suitable for the manufacture of grease and for other uses where a superfine hydrate free from grit is necessary.

Space has been left in the building, and all arrangements made for adding another hydrator and separating system whenever it is desired to double the capacity of the plant, which has been designed with this end in view.

From the dust collector, the hydrate, as we have

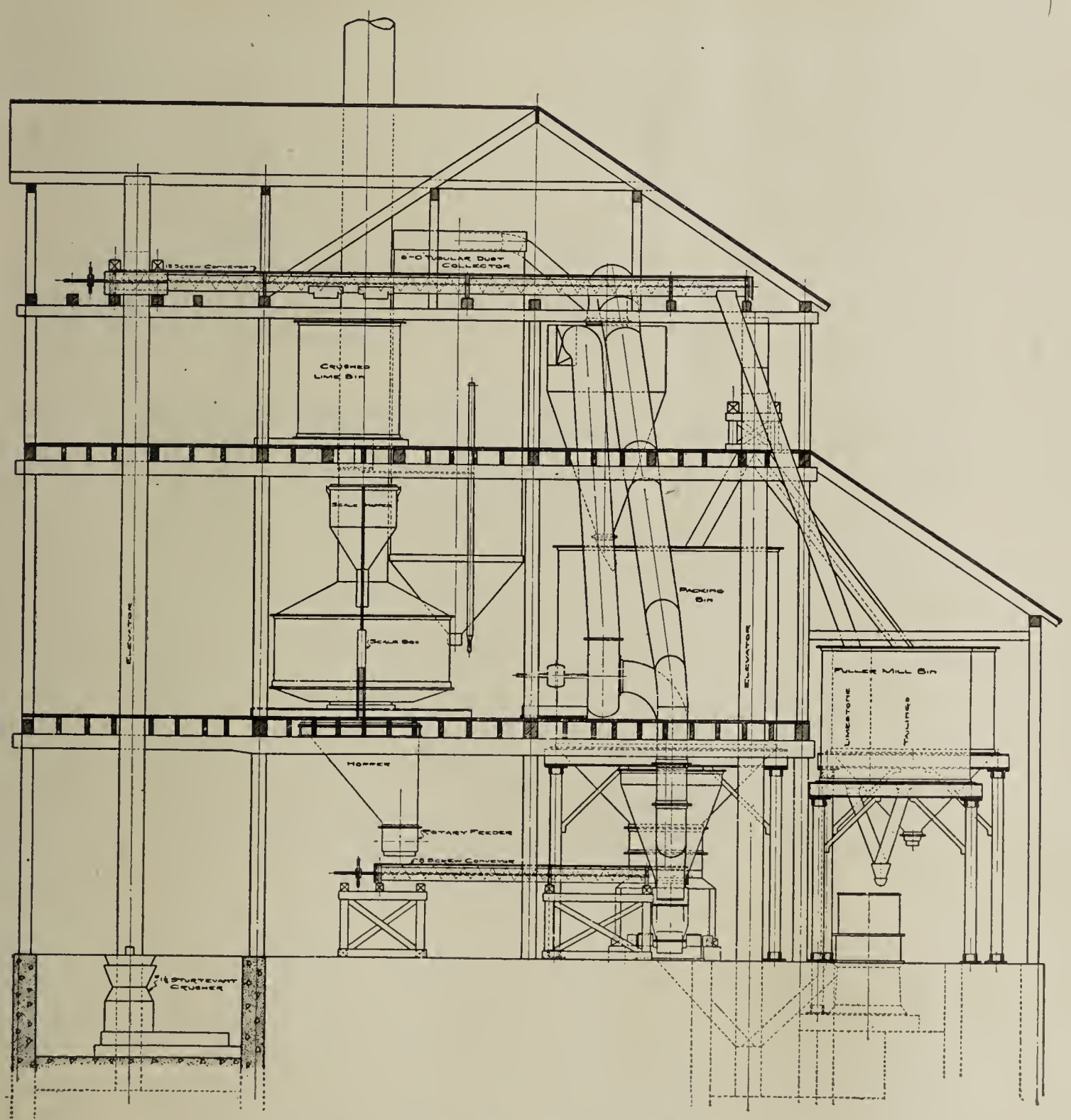


Fig. 3. Side Elevation, Hydrating Plant.

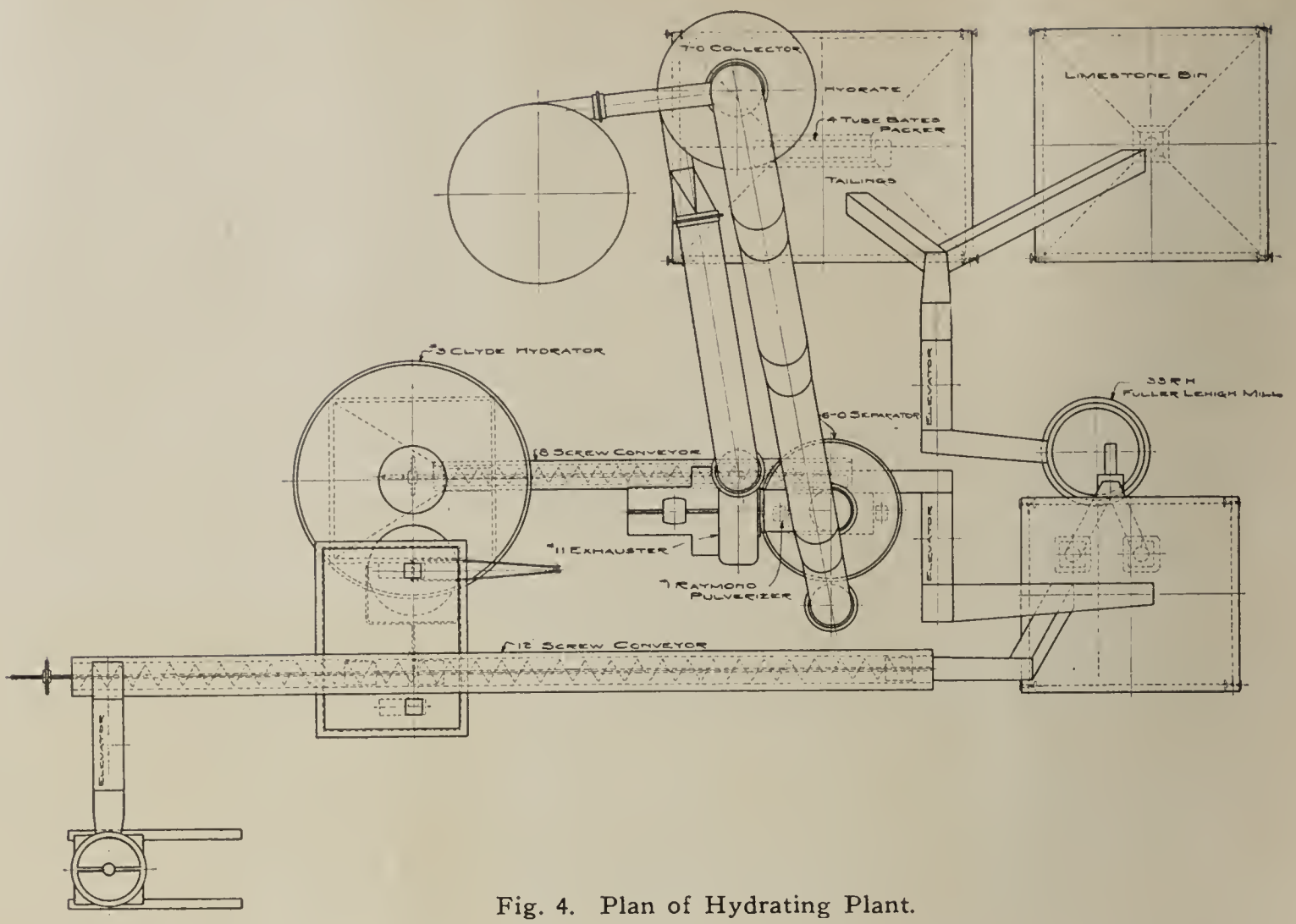


Fig. 4. Plan of Hydrating Plant.

said, falls into a bin above the packing machine. This latter is of steel plate supported on steel columns and holds 40 tons of hydrate. A novelty in its construction is a partition dividing it into two parts. By an arrangement of slides, hydrate may be packed from either side with the same packing machine. This feature is designed to allow two grades of hydrate to be manufactured at once, the uniform product being obtained from the Fuller mill as explained further on. The packing is done by the Bates packer and the Bates valve bags are used (Fig. 7). This packer is now being equipped with a dust catching system which will remove practically all of the dust and will make the plant almost dustless. This system consists of a suction fan connected with a pipe running along behind the packing machine. Branches with openings extend to the tubes of the machine and the spill from the tubes is sucked away through the pipe. The dust is discharged into the dust collector of the Raymond system.

A feature of this plant is the equipment for pulverizing limestone. For this purpose a 36-in. Fuller mill is employed and with it almost any fineness desired can be obtained. Where the limestone is desired for agricultural purposes the mill is provided with a ¼-inch mesh woven wire screen. This gives a product sufficiently fine for farm requirements. At this fineness the mill will grind about 5 tons of the Dover Plains dolomite per hour. The limestone to be pulverized is passed through the same crusher used for the lime, goes up the same elevator and into a screw conveyor which carries it to a bin over the Fuller mill. As the capacity of the crusher is 8 to 10 tons per hour, this is amply large enough to take care of both the hydrator and the pulverized limestone department by hydrating first on lime and then on stone. The discharge from the Fuller mill is taken up by an elevator to another bin and it may be packed from this into bags by hand or it can be spouted directly from the discharge of this elevator into the cars.

There is also an elevator leading from the throwout

Fig. 5. The Clyde Hydrator.

of the Raymond mill. This takes the tailings from the latter up to the bin above the Fuller mill (which latter bin has a special compartment for these tailings) where they can be mixed with limestone and ground for agricultural purposes or they can be mixed with fresh hydrate ground and elevated into one of the

Fig. 6. Raymond Pulverizer in Plant of the Dutchess County Lime Co.

compartments of the hydrate packing bin. The idea of this latter arrangement is to allow the making of a very fine hydrate by adjusting the Raymond mill to reject all but the finest hydrate. The coarse material so rejected is then ground in the Fuller mill and sold as second-grade or mason's hydrate. The two compartments in the packing bin are to allow the two grades of hydrate to be manufactured simultaneously.

Figs. 3 and 4 show the general arrangement of the hydrating plant.

Power for driving the plant is obtained from a Murray Corliss engine which can develop about 135 H. P. Steam for this is supplied from two water tube boilers which have a rated capacity of about 60 H. P. each. The machinery installed at the present time requires about 75 H. P., the additional power available being intended for the plant after its capacity has been doubled.

Coal for the boilers is brought in on the south side of the plant on an elevated track and dumped into a pocket opposite the boiler, while the coal pockets for supplying the lime kilns are located further on along the same trestle. The coal is elevated to the firing floor by the use of a bucket elevator. The cars to be loaded are brought in on the north side of the plant and the platform from the bagging machine is on a level with the car floor.

The kiln building is 60x53 ft. and is of steel covered with corrugated iron. The firing floor is of concrete and steel and all of the ground floors throughout the buildings are concrete. The hydrator building is 60x53 ft., of frame covered with galvanized iron and the construction throughout is of heavy mill-type. At the present time a storehouse 53x100 ft. is being built. This is of light steel construction and will be covered with galvanized iron. This storehouse is designed to hold hydrated lime in bags. It is the intention, however, very shortly to put in a steel tank storage in which the hydrate will be stored in bulk as manufactured and then conveyed back to the plant for packing, as desired for shipment.

The bins are all of steel and with the exception of the crushed lime bin are all supported on latticed columns. All the elevators are encased in steel and are of the chain bucket type. The conveyors are of the screw type and work in steel troughs. The main shafting is supported on concrete piers, and clutches are used to make the operation of the plant more flexible. The hydrated lime plant can be operated at its full capacity with but five men and it is believed that for quality of product and ease of operation it will not be surpassed by any hydrated lime plant in the country.

Second Floor Showing Raymond Special Exhaust Fan in Center and in the Rear at Left of Photo Is Seen the Raymond Tubular Dust Collector.

All plans and specifications for the hydrated lime plant were prepared by the writer, who also drew plans for the general arrangement of the entire plant, selected the mill site, prospected the store deposits, etc. The construction work was in charge of Mr. Ambrose Allen, superintendent of the plant.

MONARCH CEMENT COMPANY'S IMPROVEMENTS

T. J. Klossoski, cement mill engineer, is now in Humboldt, Kansas, remodeling the Monarch Cement Company's plant, putting in complete coal installation, clinker handling equipment, entirely new raw and clinker grinding departments including big hammer mills and largest size tube mills, new sacking department and other improvements. This work is now practically completed and enables the plant to run on coal, oil or gas, whichever proves most economical at the time.

ELECTRIC CAPS FOR WET WORK IN QUARRY BLASTING

With very few exceptions those who use explosives for blasting purposes have to contend with water in the bore holes to a greater or lesser extent. When blasting by electricity and there is very little water encountered, satisfactory results will be obtained by using the ordinary type of electric blasting caps. However, when a considerable quantity of water is found in the bore holes, it is more economical to use electric blasting caps that are made for this special condition. The reason for this is that the cotton insulation on the wires of an electric blasting cap only furnishes protection to the wires from abrasion and slight protection from water, the water easily penetrating the cotton insulation, causing short circuits and consequently misfires, which are not only expensive but also dangerous.

Because of the water conditions we have placed on the market two kinds of electric blasting caps to meet the demands and also to furnish the consumer with an electric detonator which can be used under the most severe conditions, writes the Du Pont Powder Company of Wilmington, Del. One kind is known as the Du Pont Waterproof Electric Blasting Cap and the other as the Du Pont Submarine Electric Blasting Cap.

The construction of these two kinds of electric blasting caps is exactly the same so far as concerns the detonating charges they contain, the wires, the cotton insulation on the wires and the filling material above the detonating charge. The difference will be found in the length of the copper shells, the insulation under the cotton insulation and the gutta percha covering the copper shells and extending about two inches up the wires on the Submarine type. The length of the copper shells of the No. 6 Waterproof and Submarine types is 2¾", of the No. 8 Waterproof and Submarine types is 3".

While the Waterproof and Submarine types cost more than the ordinary type, yet where water is encountered they are more economical and satisfactory to use, and users of blasting supplies should use them to obtain best results and eliminate the liability of misfires.

In quarrying, railroad blasting, tunnel blasting, shaft sinking and so on, where a depth of water not over 30 feet is met with, the Waterproof type should be used. Where the water is over 30 feet deep then the Submarine type should be used.

The Waterproof and Submarine Electric Blasting Caps are made with copper wire only. They can be secured with wire lengths as follows:—

4′	8′	12′	16′	20′	24′	28′
6′	10′	14′	18′	22′	26′	30′

although longer length wires may be had if necessary.

The Submarine Electric Blasting Caps will not be carried in stock and orders will only be filled as received.

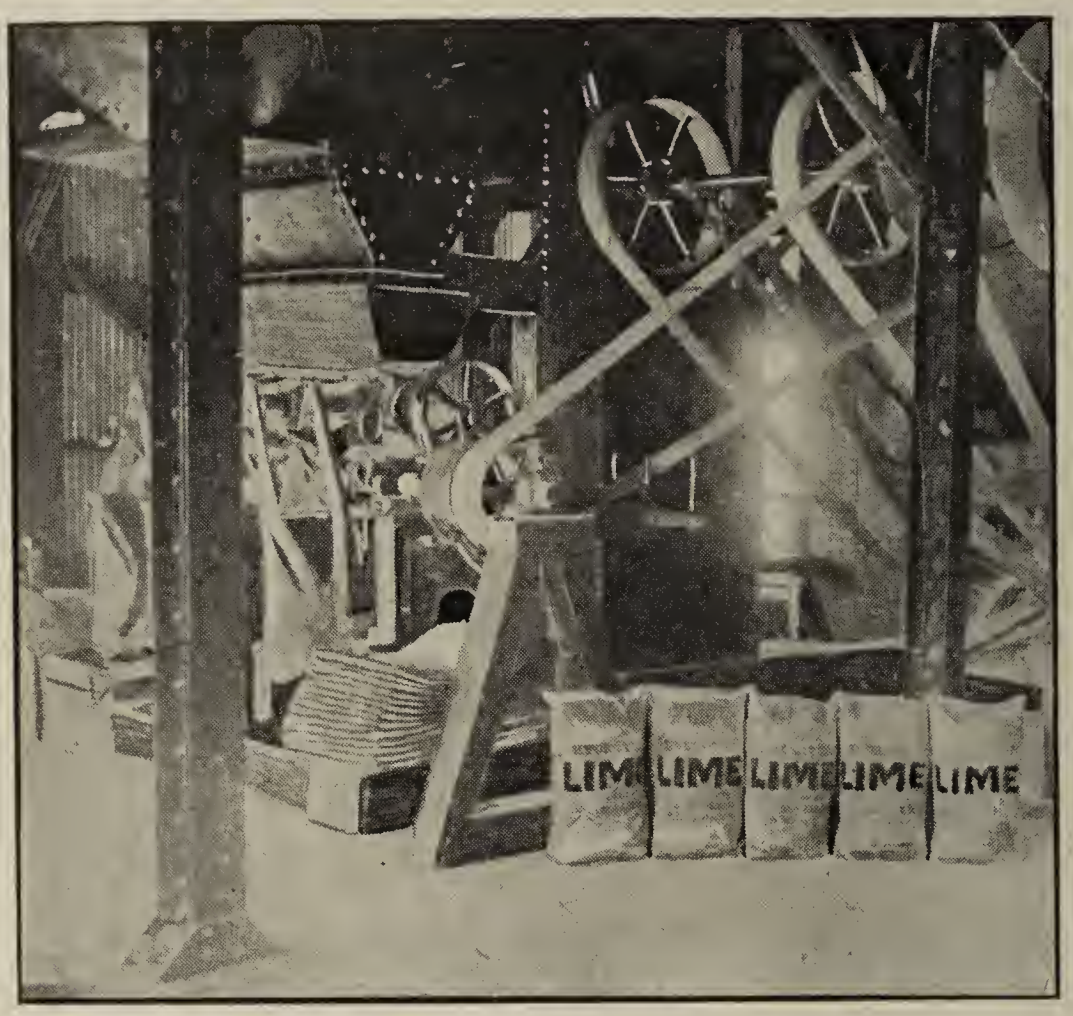


Fig. 7. The Urschel-Bates Valve Bag Packing Machine in the Dutchess County Lime Plant.

SCARCITY OF LABOR CALLS FOR BETTER ARRANGEMENT OF EQUIPMENT IN QUARRY METHODS, TRANSPORTATION AND CRUSHING PLANTS

All that we have said in the past about the need of equipping quarrying and crushing operations with every possible labor saving machine tool is very forcefully illustrated at the present time in many localities. Quarry labor, once in very abundant supply, has disappeared altogether, so that some of the most extensive as well as the smaller operations have either been forced to close down or have been unable to make a start as yet. Wages have been advanced again and again without effect. The men are scare and they know it, and they are working that knowledge for all it is worth. Equipment, the best available, without regard to the first cost, is the only way out for those who have a demand for their product and must run their plants. Even if the labor shortage in your quarry has not bumped you a body blow yet, be sure that it is coming sooner or later, with the odds heavily on sooner.

Obtaining Sand From the Bottom of the Great Lakes

To the layman, sand is sand, but to the experienced sand company, engineer, contractor and architect, there are many different kinds and grades, each fitted for some special use.

Sand and gravel are not only secured from banks on dry land, but from the bottom of the Great Lakes by vessels built for this particular purpose. The "Sand Sucker," as it is called, makes trips to certain select spots of the Great Lakes and sucks sand from the bottom of the lake. The boat then comes to the city and unloads the material either at the distributing yards or delivers it where it is to be used.

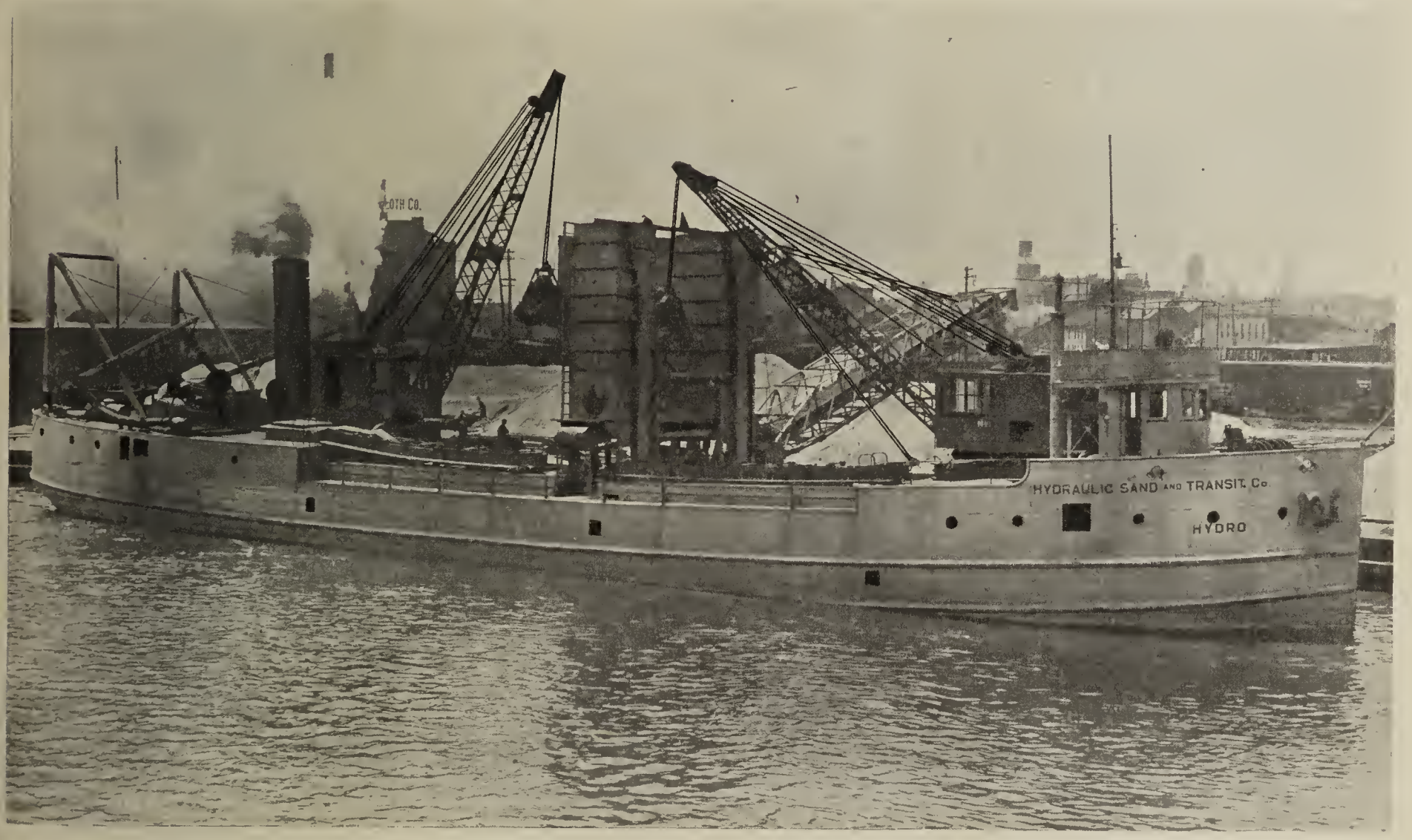
The Hydraulic Sand & Transit Company, Chicago, have in operation what is said to be the most modern vessel used exclusively for sucking sand from the lake bottom. This boat, the steamer "Hydro," has a capacity of 1,000 cubic yards of sand, which is sucked up by two 12-inch Morris centrifugal suction pumps into the storage bins. This is accomplished in about one hour and a half, while the unloading takes only three and one-half hours, or at the rate of about 250 yards per hour. The unloading is facilitated by means of special devices and in using the conveyors the material can be deposited 75 feet back from the docks. It is also possible to unload the boat with the clam-shell buckets.

Special machinery is provided for taking the surplus water and moisture from the sand, a feature not usually found in sand suckers, as in general practice about 30 per cent of moisture is contained in sand obtained from water depths. This means that sand is delivered to the dock in practically a dry state.

The "Hydro" is equipped with two very large pockets, and according to its owners is the only steamer of this kind especially fitted with apparatus for pumping out the cargo. The machinery for handling the sand from the hoppers to the wheeling device consists of a 42-inch conveyor, 75 feet long, with heavy Gutta Percha & Rubber Mfg. Co. roll belts and two Kiesler clam-shell buckets, attached to a 20-ton locomotive crane.

The Kiesler patented clam-shell buckets are manufactured by the Jos. F. Kiesler Company, Sangamon and Pratt streets, Chicago. The Hydraulic Sand & Transit Company declare they are the best buckets they ever used. They find them superior to any others on the market, having discarded two other makes for the Kiesler buckets, which are the only buckets on the market that are operated by the powerful multi-system of levers (patented) which forces the bucket to dig in instead of lifting out of the material when closing, requiring less power to operate and averaging a full capacity load.

The "Hydro" is equipped throughout with Leschen wire rope. This boat has a speed of 12 miles per hour and can make a trip of 100 miles and deliver a load a day. The "Hydro" was designed and built complete by the Manitowoc Ship Building & Dry Dock Company, Manitowoc, Wis., which owns all patents on conveying apparatus, etc.



"Sand Sucker" owned by Hydraulic Sand & Transit Co. This steamer has a capacity of 1,000 cu. yds. of sand which is sucked up by two 12-inch Morris dredge pumps. Two Kiesler clam shell buckets attached to a 20-ton locomotive crane are used for unloading material at the docks.

THE JAEGER SPOUTING PLANT FOR THE AVERAGE CONCRETE JOB

Spouting systems have become almost universal in concrete work where considerable concrete is placed over a rather large area. When chutes are used, it is not necessary to move the mixer around, but it can be placed in the most convenient place and the concrete chuted from a tower or elevator directly into the forms.

Here is an arrangement—and it was the big sensation of this year's Cement Show—that is particularly suited to the average concrete job, whether large or small. On the average small job most of the concrete is placed below grade and up to about 10 feet above grade. The inclined track with the skip car and the two chutes will make placing of concrete on these jobs very simple. The illustration shows the location and use of the equipment on the average job. The mixer can be placed in the most convenient position and the inclined track run to a position where as large an area of the work can be covered as possible.

The speed of the work is increased because the entire batch is dumped into the skip car and not into several wheel-barrows. This arrangement also increases the capacity of the mixer as a new charge can be mixed when the skip car is being dumped.

The power to operate the skip is furnished by an auxiliary hoist that is connected to the engine on the opposite side from the mixer. The whole plant for mixing and handling the concrete is therefore operated by one man.

This useful and efficient system of spouting is being placed on the market by the Jaeger Machine Co., 212 W. Rich street, Columbus, Ohio. They have an attractive little booklet entitled, "Nine Reasons Why You Should Decide on the Jaeger Spouting Outfit." Ask them to send you a copy.

The Jaeger Spouting Plant.

DUNN CONCRETE MACHINERY

A most complete list of concrete machinery of all kinds is contained in the new catalog that is being put out by the W. E. Dunn Mfg. Co., 414 24th street, Holland, Mich. For the man who is interested in cement products of all kinds, this catalog is especially useful and valuable. It is well illustrated with cuts of their many machines including cross sections which show the method of operation. Extensive descriptions are also given of the operation of their machines. These descriptions are complete enough so that a very good idea can be obtained of the operation of the various features of the many types of Dunn machines.

There is an exceptionally complete line of tile and pipe machines shown. These run from small molds that are poured by hand to large automatic machines that will make from 3,000 to 3,500 tiles per day.

The mixers illustrated also cover a wide range in capacity and price. They are also equipped in various ways to cover each particular type of work.

Molds for all kinds of concrete work such as blocks, posts, bricks and a variety of ornamental shapes are included in the catalog.

The wide range of machinery shown and the attractive way in which the catalog is made up will make it a valuable book for any man who is interested in concrete products of any kind.

Copies of this catalog can be secured by writing to the W. E. Dunn Manufacturing Company. The title of the catalog is "Dunn Concrete Machinery."

CEMENT BUSINESS IMPROVES.

Business in an increased volume is expected this year by the International Portland Cement Company, Spokane, Wash., according to statements made by the president after the annual meeting recently held.

The officers elected are:

J. S. Irvin, president, Ottawa, Can.

C. A. Irwin, treasurer and general manager, and Charles T. Sechrist, assistant secretary.

Besides Mr. Irwin the eastern directors prominent in business affairs are James Carruthers of Montreal, W. F. Powell of Ottawa, Edward Bryan of Coaticook, Quebec, and Frank Carroll of Quebec.

"Notwithstanding the bad trade conditions of 1915 and the general halting in building operations, which greatly lessened the demand for structural materials of all kinds, causing prices to fall much below the normal, the annual report of the company was satisfactory," said President Irvin.

"The report of the directors to the shareholders shows that general trade conditions have improved during the last few months, and from orders booked and general prospects the company is making plans to handle a larger volume of business in 1916 than in any previous year."

A NEW LINE OF BEARINGS THAT INSURES LONGER LIFE—INCREASED OPERATING EFFICIENCY AND ECONOMY

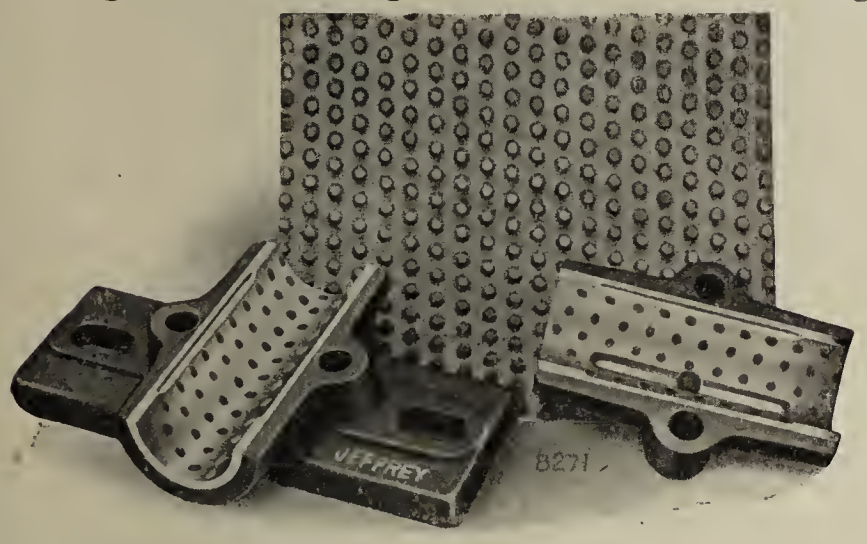
Users of transmission machinery will be interested to know that the Jeffrey Manufacturing Company of Columbus, Ohio, the well known manufacturers of power transmission, elevating, conveying, screening and crushing machinery, are now furnishing their standard bearings with the famous Randall graphite sheet lubricator, which is rapidly being adopted by manufacturers and managers of industrial plants in all lines of business, with most excellent results.

All men who are familiar with bearing troubles, as well as the highest engineering and mechanical authorities, concede that graphite is the best existing lubricant, but up to the present time the difficulty has been to combine graphite and babbitt metal.

This problem, however, has now been solved to the satisfaction of the most exacting, by a simple patented mechanical device consisting of solidified pure graphite cones, slightly tapered and attached by hydraulic pressure to a fine copper wire screen or fabric. The babbitt metal is poured in the usual way and sets around the cones, making them part of the bearing, which is thus made practically self-lubricating, and eliminating all friction.

The experience of many users is that not a single hot box has ever occurred where the Randall graphite sheet lubricator has been properly installed.

The use of oil with Jeffrey bearings may be, and often is, entirely eliminated. In no case does it amount to more than 10 to 25% of the usual consumption of oil or greases—a saving that would run into large



Jeffrey Standard Bearings.

figures in any shop or factory having a considerable equipment of machinery.

This lubricating device will enable Jeffrey babbitted bearings to stand up under heavy pressure and high speeds without heating, assuring an appreciable increase in operating efficiency with a substantial saving in operating cost.

In addition to the economies of oil, babbitt metal, time and labor, the slight amount of oil required for bearings so equipped overcomes all oil-soaking in the belt, and the saturating of the machinery with oil is also avoided.

The Jeffrey Manufacturing Company have recently issued Bulletin No. 179-14, fully illustrating and describing their graphite sheet lubricator bearings, a free copy of which may be obtained by writing to their home office, 914 North Fourth street, Columbus, Ohio, or to any of their branch offices or agencies.

The Jeffrey line of bearings, pulleys, hangers, chains for all elevating, conveying and power transmission purposes, elevator buckets, casings, boots, take-ups, sprockets, etc., is proving a very desirable and profitable line for dealers to handle, and their attractive agency proposition is open to selling agents.

CONVEYOR BELTS

The conveyor belt idea is applicable to almost every industry. Have you ever considered the advisability of applying this mode of conveying in your own plant? In some industries a larger percentage of the factories have adopted belt conveyors than in others. Both

Belt Conveyor Loading Barges Equipped With Sawyer Belting.

the gravel, crushed stone and cement plants have found a solution of their conveying difficulties in the belt conveyor. Hardly a plant of any size in these industries exists that doesn't use belts for this purpose.

In some of the other branches of productive trade, a smaller percentage of the factories involved have been equipped with belt conveyors. It is to these people that we direct our proposition. We want them to know how and why the can overcome many perplexing difficulties by adopting this idea. We want them to know how other plants have benefited, writes the Sawyer Belting Company of Cleveland.

To this end we offer the combined efforts of our engineering and sales departments to place the matter before you in a way that you will appreciate the advantages to be gained. Both departments are kept constantly in touch with the operation of conveying equipment, and can tell you what other factories have done along this line, and how it can be applied to your own plant.

ISSUE PAMPHLET ON USE OF HYDRATED LIME FOR CONCRETE ROADS

A discussion of the use of hydrated lime in concrete roads has been issued in pamphlet form by the National Lime Manufacturers' Association of Pittsburgh. No claim is made that the use of the material will prevent or overcome defects in concrete roads built under unfavorable conditions. It is stated, however, that the addition of hydrated lime will, to a great extent, overcome such defects as cracking and soft spots, and will generally improve the durability and wearing qualities of any properly constructed concrete road.

Statements of men of authority in the roads field, who have used hydrated lime, are included in the pamphlet.

THE REPUBLIC "SIX" CONCRETE MIXER.

This may sound something like a last year's automobile, but it is not. It is the latest style of concrete mixer made by the Republic Iron Works, Box 454, Tecumseh, Mich. The manufacturers believe that in this they have the most complete and up-to-date mixer ever made and the literature which they have forwarded us would indicate that there is good reason for their opinion. The mixer is complete with a loading device which permits charging the mixer from a wheelbarrow directly on the ground and with a discharge device which will empty the mixer in a waiting wheelbarrow on the other side.

The Republic "Six" depends for the mixing action upon a scientifically designed system of paddles and chutes which turn the mass over and over and from side to side, thus making a prefectly homogeneous mixture. In fact, for every revolution of the drum, there are a number of complete turn-overs of the concrete. It will be evident to anyone that this will secure a complete mix in a very much less time than where the mixing is dependent upon the action obtained in the old style barrel, which often merely rolled the mass around without performing any particular mixing action.

The Republic "Six" mixes from five to six cubic feet per batch and as the drum can be charged or emptied when revolving at full speed, there is no reason why a batch should not be completely mixed in a minute or less. Thus giving it a daily capacity far in excess of the ordinary mixer of the same drum capacity.

The Republic "Six" is only one of a number of concrete machines made by the Republic Iron Works, others being concrete block machines, sill and cap moulds, and mixers of various styles and sizes. The complete catalog of the Republic "Six" will be sent to our readers on request, as well as any of the other special catalogs on concrete machinery made by the Republic Iron Works.

ACME CEMENT PLANT NOW IN OPERATION

Construction of the mill of the Acme Cement Corporation four miles south of Catskill, New York, has just been completed with a capacity of 2,500 barrels of Acme cement per day, operating with the wet process.

The mill has been in operation since February 1 of this year, and at the present time is turning out about 1,200 barrels per day, and as soon as sufficient room is made in the quarry inside of sixty days the mill will be operated at full capacity.

Mr. C. J. Reilly, who has had charge of the redesigning and construction of the mill, which was formerly built by the Seaboard Portland Cement Company, has decided not to remain and operate the plant after June 1, after which date he will make his headquarters in Chicago, working on a new western proposition.

REINFORCED CONCRETE RESERVOIR

An interesting reinforced concrete reservoir, cylindrical type, has recently been erected by the city of New Ulm, Minnesota, for municipal service. This

Reinforced Concrete Reservoir, New Ulm, Minn.

structure, built entirely above ground as shown in the accompanying illustration, is 32 ft. in diameter, inside, with walls 15 ft. high, and has a depth to outside flow of 12.5 ft., affording a capacity of 90,000 gallons.

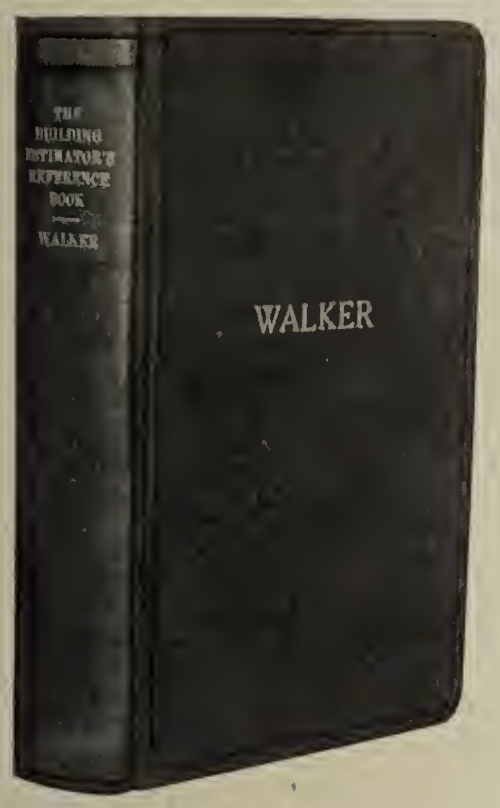
The floor, walls and roof, of standard rod and bar reinforcement, are of a 1-2-4 concrete mixture, with addition of 5 per cent hydrated lime. After the removal of the forms, a 1-2 mixture of cement mortar, including 10 per cent hydrated lime and 3 per cent cement waterproofing, was applied to both inside and outside walls as a finishing coat, about ½ in. thick.

The roof of the reservoir is supported on a framework of steel I-beams and comprises a 4 in. reinforced concrete slab, with finish coat ½ in. thick, composed of a 1-2 mixture of cement and sand. Paneled walls and moulded coping augment the attractiveness of the structure, which is provided with a wrought iron stairway for an entrance near the roof level.

Economical cost factors governed the erection of this reservoir, representing a total of $5,360; of this amount, the concrete work, exclusive of reinforcement, cost $2.560, and the structural steel and piping $2,800. The structure was designed and erected under the supervision of Mr. F. D. Minium, city engineer of New Ulm.

BUILDING ESTIMATOR'S REFERENCE BOOK

"Stop guess-timating, start estimating." That is the suggestion made by Frank R. Walker in a little brochure, relating to "The Building Estimator's Reference Book," which he has just published. Has any one ever studied just why it is that there are such great variations in competitive bids among contractors?



Among the reasons suggested by Mr. Walker are these: Mistakes in taking off the quantities from the plans, or mistakes in the extension of figures; inexperience regarding the performance of certain classes of work, resulting in "wild" guessing as to the cost of same; many contractors make no attempt to keep unit costs on their work, and where they attempt to do so costs are not analyzed so as to make them valuable for future estimates.

In recent years among business men the subject of costs has received special attention, and those men who have acquired efficiency in estimating costs accurately possess an enormous advantage over those who have not. Mr. Walker calls attention to a few of the possible oversights. When you are estimating a concrete reinforced concrete job, he inquires, do you consider the quantity of lumber required to complete one square foot of forms? Do you consider the number of square feet of forms you can obtain from 1,000 feet of lumber? Do you consider the quantity of lumber a carpenter has to handle and place to complete 100 square feet of forms?

Thousands of similar questions might be asked. The answers are found in "The Building Estimator's Reference Book." Get this book on five days' approval from Cement and Engineering News, 672 Transportation Bldg., Chicago.

DEALERS WANTED

The Sandusky Cement Company, T. 1 Engineers Bldg,. Cleveland, Ohio, want representatives in every city and town in the United States, to handle Medusa Waterproofing, Medusa White Portland Cement and Medusa Waterproofed White Portland Cement. This action is necessary on account of their extensive advertising campaign, which is bringing thousands of inquiries from every section of the country.

This is truly a rare opportunity for a dealer to add these well-known materials to the builders' supplies he is now handling, and their sales co-operation plan will enable the dealer to greatly increase his profits without charge to him.

DISTINCTLY SUPERIOR

Western Dump Wagons

They combine LIGHTNESS, STRENGTH, and CAPACITY, with durability and ease of operation. Elimination of much weight without sacrificing strength is the big feature of the Western Wagon. How well we have succeeded in doing this is shown by the records of this wagon on a great many jobs. If you want a good, durable LIGHT and STRONG WAGON get the WESTERN.

Western Wheeled Scraper Co.
Aurora, Illinois

THE MIXER WITHOUT A WEAK POINT
1800 IN USE

BOSS HIGH SPEED
BUILT OF STEEL
AND EQUIPPED WITH
HYATT ROLLER BEARINGS
5-7½-10-15 FT. SIZES
Stock in Principal Cities
WRITE FOR PRICES
AMERICAN CEMENT MACHINE CO.
9635 Johnson St. Keokuk, Iowa

REDUCE COST OF UNLOADING CARS

Why unload material by hand at a cost of 15 cents to 20 cents a yard? When you can unload material from cars to trucks with an Eclipse unloader at a cost of 2 cents a yard.

The Eclipse Portable Stone Unloader does this by

unloading your crushed stone, gravel, sand, slag, coal, etc., from hopper bottom cars to wagons at the rate of 10 cars per 10 hour day.

Your wagons or trucks are loaded in ½ minute instead of ½ hour—by one man instead of 10 or more shovelers. No delays, no waiting for loads—your drivers and hauling equipment are kept busy all the time.

The Eclipse Portable Stone Unloader is saving contractors thousands of dollars annually. Go over your cost records and figure how much money an unloading cost of 2c a yard would save you—then write for all the facts to Arthur C. Kretzer, Room 672 Transportation Bldg., Chicago.

DUSTLESS CONCRETE FLOORS

The Sandusky Cement Company, T1 Engineers Bldg., Cleveland, O., have had printed and are distributing without charge, through courtesy of the Journal of the Association of Engineering Societies, an eight page pamphlet entitled "A Simple Method of Securing Dustless Concrete Floors," by P. M. Bruner, member of The Engineers' Club, of St. Louis, as read before the club, March 17, 1915.

EAU CLAIRE CONCRETE COMPANY

One of the enterprising manufacturing plants at Eau Claire, Wis., is that of the Eau Claire Concrete Company. This plant has been in business for nine years. It has produced building blocks, silo blocks, posts, ornamental work, etc. It uses a Dunn block machine, and also the Zagelmeyer system. The plant is located along side a large sand and gravel deposit and the gravel is conveyed into plant by belt conveyor.

The Waterloo Bar Bender will pay for itself on the first job

No. 2 Machine Bends to including 1⅛" Bars, weighs 110 lbs. Price - - **$18.00**
No. 3 Machine Bends to including 1½" Bars, weighs 210 lbs. Price - - - **23.00**
Machine Stand weighs 90 lbs. Price - **10.00**

The price of this bender is returned to you in time and money saved on your first job, and the machine itself is indestructible, so you multiply this saving year by year.

Makes bends at various angles to meet any design. Bending posts of turned steel. The post that revolves through the slot in the plate is equipped with loose steel roller to keep bar from creeping during bending. Machine is furnished with detachable handle 7 ft. long. No. 2 machine is especially adapted for field work.

Waterloo Construction Co., - - Waterloo, Iowa

Fuller Face Hardened Sprocket and Traction Wheels

Unequaled for severe duty. Proven by test. Their use prolongs the life of chain.

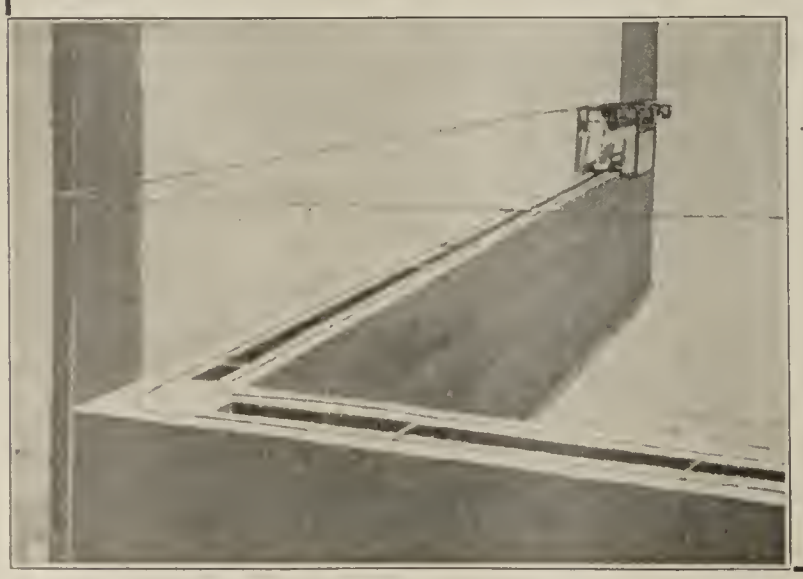
RESULTS:—Increased Efficiency—Saving in Operating Cost.

We manufacture all kinds of wearing parts subjected to abrasion.

Write for Fuller Quality Products Catalog No. 50—C

Lehigh Car, Wheel & Axle Works, :: Catasauqua, Penn.

This Simple, Economical, Rapid Form of Hollow Wall Construction gives you a lease on the building of



bungalows, houses, garages, factories, ice houses, foundation walls, etc., in your community. Its saving over cement block, tile, brick or wood construction is enormous. One operator can build as rapidly as three men can mix and carry the concrete to the form. No delay waiting for concrete to set. Simply spread and tamp the fresh concrete in the machine until filled, then raise the lever releasing the machine from the wall, move it forward, reclamp on the wall and repeat the operation. No wooden forms required.

The 2-E is simple to understand and operate.

Build hollow concrete walls that are storm-safe, fire-proof, insulated from heat and cold and impervious to moisture! Do it at smaller cost and greater profit with the 2-E Flexible Concrete Form! Write for circular describing this form and its operation in detail. The facts will surprise you. Our Concrete Silo Forms are simplest and least expensive. Enables you to build a silo with double walls thoroughly insulated by dead air space; solid walls if desired.

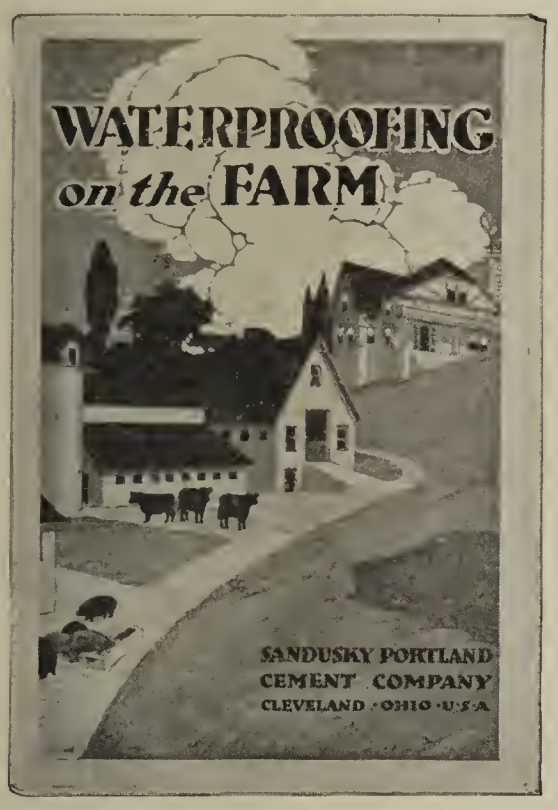
2-E Flexible Concrete Forms

OFFICE: EAGLE, WISCONSIN

Demonstrating and Salesrooms 225-227 West Illinois Street, Chicago, Illinois

THE MANY USES OF CONCRETE WATERPROOFING ON THE FARM

Concrete is now being used in all parts of the country for farm structures. The value of waterproofing as applied to these various farm buildings is brought out in a new booklet that is being distributed by the



Reproduction of Attractive Booklet Cover.

Sandusky Cement Company, T2 Engineers Bldg., Cleveland, Ohio. The attractive appearance of this booklet is clearly shown in the accompanying illustration.

The point is brought out that waterproofed concrete cannot absorb moisture and will consequently keep in the best possible and sanitary condition. For troughs, tanks, and cisterns especially waterproofing is most important.

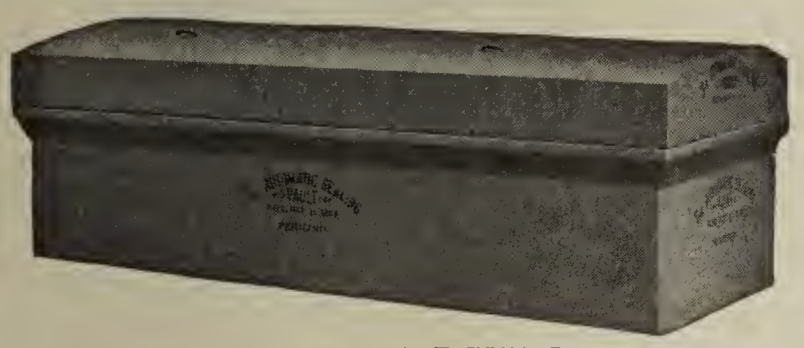
A particularly pleasing feature of this booklet is the method of illustrating. Photographs are shown of all kinds of farm structures which have been built of concrete and bring home the fact that farm buildings constructed in this way make a farm that is easily kept clean and that presents a most sanitary and attractive appearance. The illustrations are clear enough so that many valuable suggestions can be obtained as to the best methods of constructing farm buildings and improvements of all kinds.

Copies of this booklet will be sent free to any of our readers on request. Address Dept. T2, Engineers Bldg., Cleveland, Ohio.

The Sandusky Cement Company also have many other booklets dealing with various phases of concrete and waterproofing work.

MUST CUT CEMENT FREIGHT RATE

The Public Service Commission has just handed down a decision ordering the railroads carrying cement from what is known as the Nazareth cement district, which contains the following cement companies, Dexter Portland Cement Company, the Penn Allen Cement Company, the Nazareth Cement Company, Bath Portland Cement Company, Pennsylvania Cement Company and the Phoenix Cement Company, to reduce the rate from Nazareth to Easton, Bethlehem and South Bethlehem from 63 cents to 53 cents per ton.



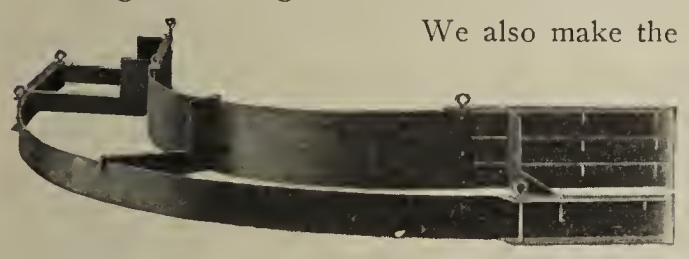
Why not make Vaults?

Have you ever investigated the money-making possibilities of the Concrete Burial Vault Business?

It is one of the most profitable branches of the Concrete Industry—either as a side line, or as a business in itself. You can make from $15 to $20 profit on every

AUTOMATIC SEALING VAULT

that you turn out. And you don't need any experience, or selling ability. Any man can manufacture Automatic Vaults, and they sell themselves. They are handsome in appearance, an everlasting protection against water, dampness, and decay; and are cheap enough for everybody. It doesn't cost much to start this business, and costs you nothing to investigate.



We also make the

Indiana Steel Forms—

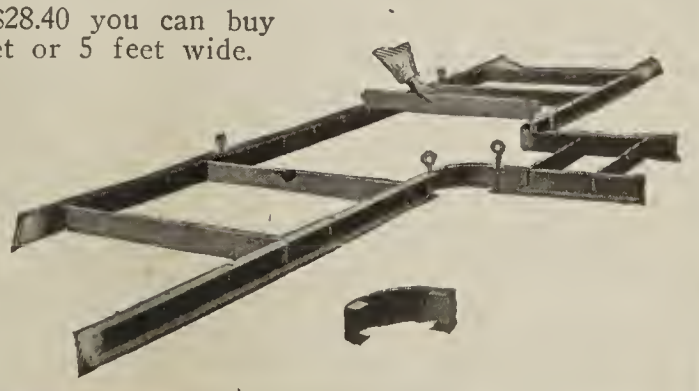
for sidewalks, and curb-and-gutter.

During the next thirty days these well-known money-saving forms will be offered at the following prices:

Offer No. 1. For $28.40 you can buy enough steel forms to lay 125 running feet of sidewalk per day—4 feet or 5 feet wide.

Offer No. 2. For $40.20 you can buy enough steel forms to lay 200 feet of sidewalk per day—4 feet or 5 feet wide.

Offer No. 3. For $59.00 you can buy enough steel curb-and-gutter forms to lay 50 running feet of curb and gutter 17 inches wide at one setting of the forms.

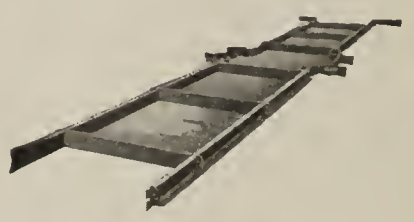


The Automatic Sealing Vault Co.

216 E. River St., Peru, Indiana

STEEL FORMS FOR CONCRETE SIDEWALKS, CURB AND GUTTER

The pressed steel forms for concrete sidewalks manufactured by Zeiser Bros., 5318 E. 8th street, Berwick, Pa., are made on a principle which is new and extremely simple. They are exceptionally light, but of maximum strength and there are no projecting rivet-



heads to interfere with the finishing tools. This is a feature that is readily appreciated. This company has also developed the Zeiser system of steel forms for concrete curb and gutter construction. Sold direct to users all over the world. Over a thousand satisfied users will tell you what they are worth. Write for a copy of their new booklet.

SAND-LIME BRICK

The San Antonio Sand-Lime Brick Company, San Antonio, Tex., reports that the demand for its products is much improved over the same period last year. The company expects to add one or two new presses to its equipment in the near future. The new owners, who are now in charge of the plant, are George Potchernick, president, and W. G. Sinclair, secretary and general manager. R. L. Cameron has been engaged as salesman to travel the company's territory, which is constantly growing.

The Hardstone Brick and Tile Company, Chicago, is a newly incorporated concern that will make a sand-lime brick, sand-lime roofing tile and fire brick. While the buildings and power plant have already been constructed at Clearing, Ill., operations will not be commenced until machinery, being imported from Germany, has arrived. The capacity will be 20,000 brick per day and 1,500 roofing tile per day. The dryer, 66 feet long, 6 inches in diameter, will be furnished by Power & Mining Machinery Company. The American Clay Machinery Company is furnishing the turntables and transfer cars.

A Big Blast-Hole Drill That's Reliable

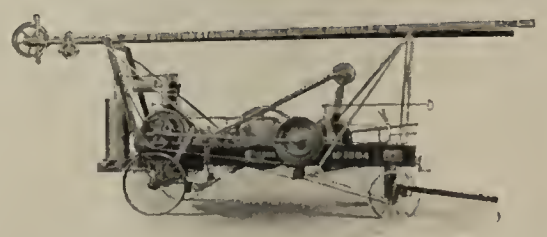
—THE CYCLONE No. 14—

Heavy, solidly braced frame—Sill timbers 4" x 14". All machinery placed directly on the main sills protecting it against strains and preventing top heaviness. **Eighty per cent (80%) of the castings are cast steel**—not cast iron. The Cyclone No. 14 is the only Blast-Hole drill so built.

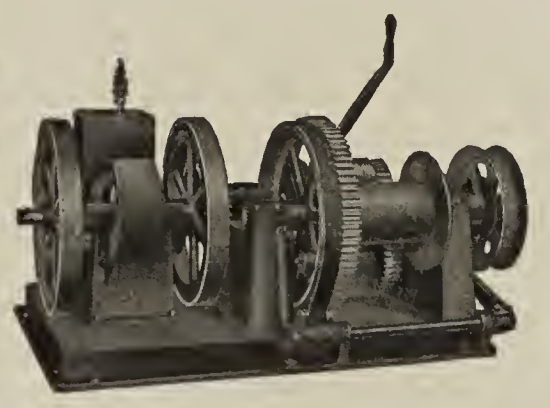
Furnished in Steam, Gasoline, Compressed Air or Electric Power; traction or non-traction.

THE SANDERSON-CYCLONE DRILL CO., ORRVILLE, OHIO

Eastern and Export Office, 50 Church St., New York, N. Y.



BUILDERS' HOISTS and MATERIAL ELEVATORS



Hoist and Engine complete, direct connected, three sizes, 5, 6 and 8 H-P.

Every up-to-date builder and contractor should post himself on the most economical way to elevate building material. We have prepared an interesting booklet on

HOISTS and ELEVATORS

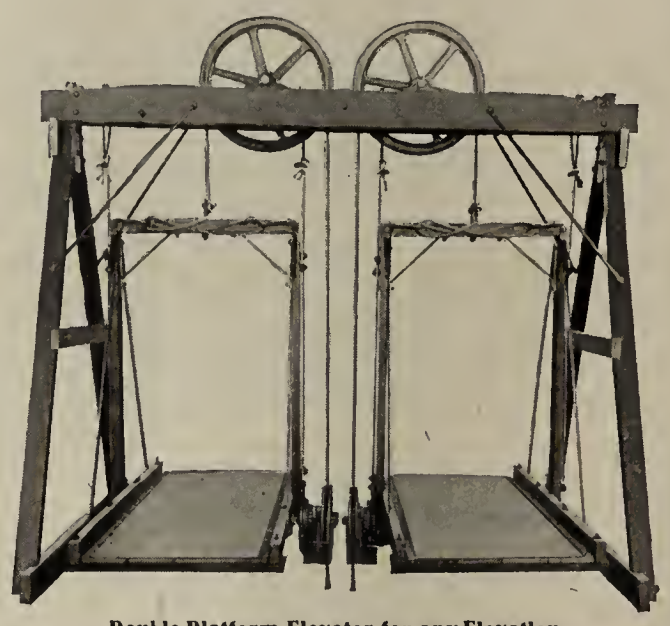
which we will send to anyone interested.

Write for it.

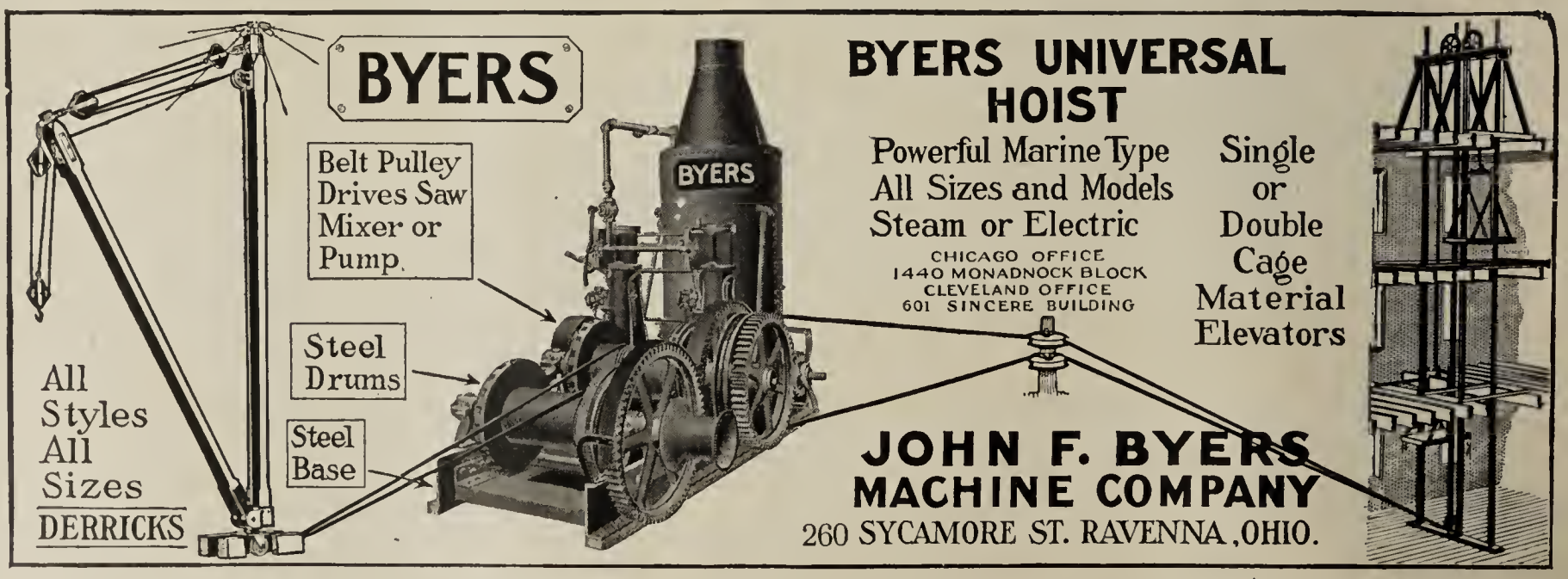
Bates & Edmonds Motor Co.

114 Hill Street

Lansing, Mich., U. S. A.



Double Platform Elevator for any Elevation



NEW LANSING PAVER FOR SMALL SIZE AND COMPACT CONSTRUCTION

The new Lansing paver is making its initial bow to the public. Although too early to predict the enthusiasm that will greet this newcomer, there is reason to expect a tremendous ovation. It fills an actual need. The size and price of the big cumbersome paving mixer has been prohibitive to the contractor who occasionally puts in a few blocks of street or concrete alley; now comes the Lansing paver, costing one-half

as much, a third less weight, and with all the earmarks that has distinguished Lansing mixers, quality plus speed, plus service.

The size is just right for the average contractor, plenty big enough for street work, and so compact it can actually be operated in a 6-foot alley. The drum easily holds, and mixes without slopping, one sack of cement, 3 parts sand and 5 parts stone, in other words, a 1:3:5 mix.

It propels itself forward or back at a speed of 1½ miles an hour. The power is amply taken care of, for the 6-horsepower Novo or Ideal engine is regularly used, although steam power is furnished to all who prefer it.

The mixer discharges into a sectional swinging chute and the concrete is run directly into place without further handling other than spreading.

All the levers have been conveniently grouped so that one man attends to loading, discharging and spouting. Samples of this new Lansing light-weight paver are now being shown at the Lansing Company's stores and warehouses throughout the various distributing centers. The factory's enormous production makes it possible to promise good deliveries.

By writing the Lansing Company, at Lansing, Mich., prospective buyers of light-weight pavers will gladly be directed to the nearest point where one of these pavers can be seen, also an illustrated circular with specifications will be mailed to any interested party. Write for catalog No. 354-P and mention Cement and Engineering News.

BOOK REVIEW

A valuable little book just published by the Norman Henley Company, New York, is entitled "Concrete for the Farm, and in the Shop," 128 pages, cloth bound, 51 illustrations, price 75 cents.

This book is not a technical treatise, but written for the everyday man; concise, practical and easily understood; innumerable directions are given for the preparing and handling of concrete, and directions for its use in every conceivable way. The Author is H. Colin Campbell, an experienced engineer in concrete construction.

The New Lansing Roadster

The Mixer for the Country Contractor

BECAUSE:

It has **24-inch front,** and **30-inch rear,** wheels.
It **follows the wagon track.**
Its **hammock bearings** absorb the bumps in the road.
Its power plant is the best mixer engine on earth—**Novo** or **Ideal.**
All wheels and bearings have **hard oil cups.**
You can have it with **sideloader** or **batch hopper, water tank** or **folding platform.**
For bridge builders it has a **rotary pump.**
For silo men it is equipped with **special silo hoist.**
The **weight is light.**
The **price is right.**

Ask about the ***Lansing Roadster,*** *Catalog 354-M.*

LANSING COMPANY
"KEEP YOUR PRODUCT ON WHEELS"

LANSING, MICHIGAN, U. S. A.

CHICAGO, 169 W. Lake St. PHILADELPHIA, Willow and N. Amer. Sts. NEW YORK, 288-289 West St.
MINNEAPOLIS, 517-519 N. Third St. SAN FRANCISCO, 338-348 Brannan St.
KANSAS CITY, 1413-1415 W. Tenth St. BOSTON, 78 Cambridge St., Charlestown Dist.
WRITE FOR CATALOG 354-M and mention Cement & Engineering News

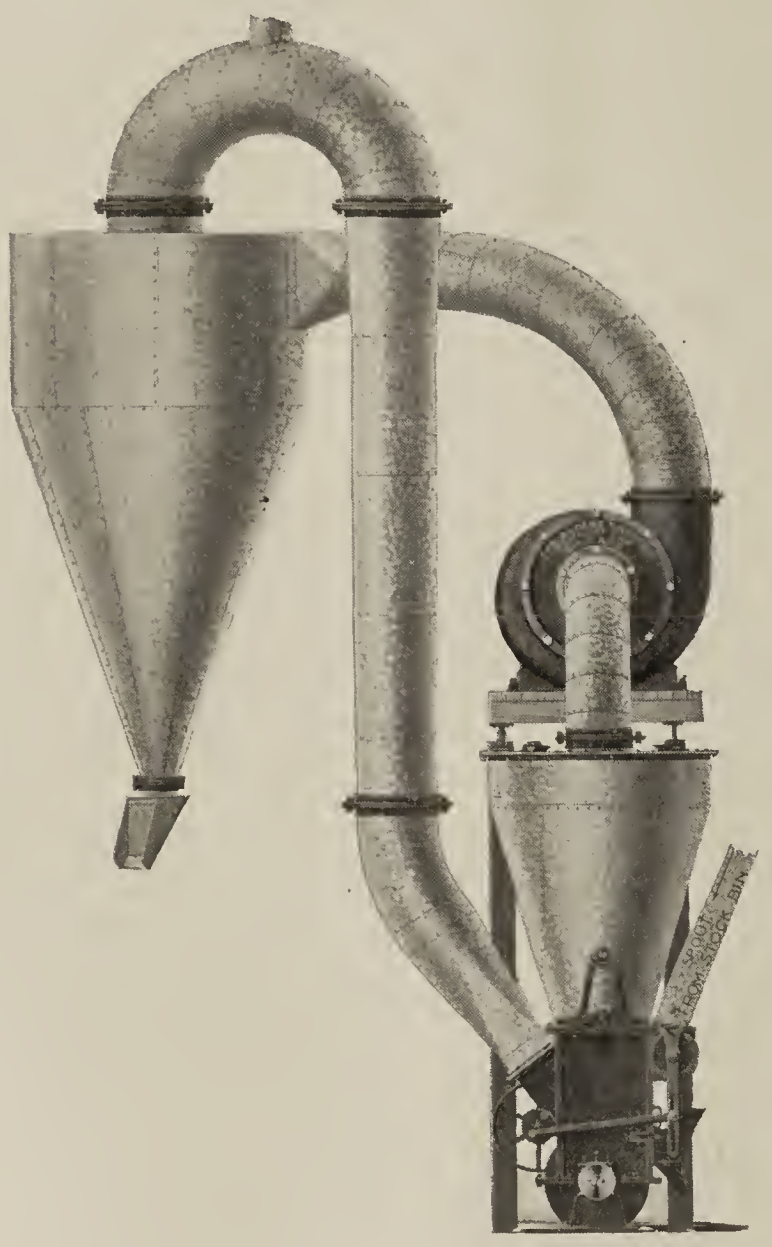
The Home of the Lansing Wheelbarrow

Produce Better and Cheaper Hydrated Lime

By Using The

RAYMOND PULVERIZING AIR-SEPARATING SYSTEM

An example of this is the Dutchess County Lime Co.'s large new up-to-date plant at Dover Plains, New York which has been equipped with the Raymond Automatic Pulverizer for the grinding and air-separating of their hydrate.



In Hydrated Lime Plants the Raymond System does more than merely grind the lime as it produces a uniform pure product from which all sand core and unburned lime has been separated by means of our Special Automatic Throw-out Attachment.

This is only one application of the Raymond System as it is used in every process of manufacture when finely ground material is required.

It is built specially for handling every different material. That is, nearly every material presents a different problem both in grinding and handling and as this system is a method rather than a set of standard machines we simply adapt this method to your grinding room giving you the best results possible.

If you have any grinding or pulverizing problem in connection with your process of manufacture the Raymond System will handle it.

At least find out what the Raymond System IS and what it can DO.

Our No. 12 Catalog is now ready for distribution, obtain your copy today

RAYMOND BROS. IMPACT PULVERIZER COMPANY

1309 NORTH BRANCH STREET CHICAGO, ILLINOIS

Apartment House for Four Families

CEMENT STUCCO EXTERIOR

A Popular Style of Multiple Dwelling Having the Appearance of a Commodious Private House.

Many of our readers are likely interested in the design and arrangement of four-family houses, and therefore the study which we illustrate herewith, but which in its external aspect has much the appearance of a large private dwelling, will command their attention. There are twenty rooms in the building. Each family has a commodious living room, a dining room, a kitchen, two bedrooms and a bathroom, with a screened porch inclosing the wash trays and which may be utilized as a laundry.

The exterior walls of the building are of stucco and the latter was applied by means of what is known as the cement gun, that is, the plaster or stucco was blown on to the wall by means of compressed air; the dry cement, sand and water being mixed as they were blown from separate tubes. The exterior wall studs were first covered with 1x6 inch sheathing put on diagonally and then covered with 5-pound waterproofing roofing felt lapped like siding and secured to the sheathing with large-headed tacks. Over the felt were placed furring strips, to which expanded metal lath was secured with 2-inch nails placed 6 inches apart. The sheets of metal lath were lapped in both directions and securely tied together by weaving wire in and out through the lapped meshes, thus making a continuous reinforced slab. All corners were wrapped with American Steel & Wire Company's fabric, lapped 4 inches over the expanded metal lath.

On this lath was applied the base coat of stucco ¾ inch thick, composed of one part Portland cement to 4½ parts coarse, well-graded sand, and 10 per cent hydrated lime as a permanent waterproofing, all being applied by means of the compressed air gun as above stated.

The second coat was applied by hand and consisted of one part of Medusa white Portland cement (manufactured by Sandusky Cement Co.), two parts of white sand and 12 per cent of hydrated lime left in as a sand finish. This stucco was kept wet for about three days to insure proper curing and bonding of both coats. We learn from the architect that it has produced a job without cracks or breaks, "thoroughly monolithic and everlasting."

The first floor joists are 2x8 inches, the second floor joists 2x10 inches, and the ceiling joists 2x4 inches, all placed 16 inches on centers.

All floor joists are covered with 1x6-inch surfaced sub-flooring, on which was placed a heavy layer of waterproofing felt. The finish floor of the main room is ⅞x2 inches square, quarter sawn, tongued and grooved oak flooring, with the exception of the front and rear porches, which are covered with 1x4-inch tongued and grooved pine flooring. In the partition between the apartments on the first and second floors was placed a layer of Natural Linofelt quilted between two sheets of strong building paper and the same was laid on the second floor joist.

The rafters are covered with 1x6-inch surfaced sheathing laid tight and over which was placed a heavy

layer of waterproofing felt. This in turn was covered with No. 1 cedar shingles laid with an exposure of 4½ inches to the weather.

The entrance to the building is prominent and gives a decorative architectural feature to the front façade. The paneled front door with glass side lights of small panes with segmental transom partakes of the colonial in style of architecture. The entrance is sufficiently recessed to form with the projection of the entablature over the columns a protection from the elements.

The large casement windows furnish an abundance of light and add materially to the pleasing effects produced.

The living room at the front of the house has a Colonial fireplace opposite the entrance doorway, the design being in keeping with the surroundings. The fireplace is constructed of buff colored brick with Colonial mantel shelf. The French doors leading from the dining room into the balcony at the side are extra large, and it is possible to convert the balcony into an open-air sleeping porch if so desired. Both the living and the dining rooms have polished hardwood floors and woodwork finished in white enamel. The doors and trim are mahogany. The electric fixtures and hardware are of a silver and bronze combination, but all harmonizing with the general scheme of interior decoration.

The center of the kitchen is but a few steps from the dining room and contains built-in cupboards, sink and breakfast nook, which is nothing more than a recess with table and seats on either side as indicated in the detail shown herewith. The drainboard of the sink is of sanitary composition. On one side of the sink is a deep cupboard for dishes and on the other side a shallow cupboard for supplies, etc. Back of the kitchen is a screened porch containing wash trays, already referred to, and from the upper porches the rear stairway leads down, all being inclosed and separate from the apartments on the first floor.

The two large bedrooms shown at the rear are well lighted and ventilated and are finished in white enamel with paper walls and tinted ceilings.

The bathroom is finished in white enameled woodwork and smooth plaster wainscoting extending up to the top of the doors. The floor is of tile with a tile base around the room. The bath tub is built-in with tile on the front running from the rim of the tub to the floor.

The four-family house here shown was erected in accordance with drawings prepared by Rex D. Weston, 507 Chamber of Commerce Building, Los Angeles, Cal., and cost complete $6,950, the structure having been erected during the past summer.

GRAVEL MOTOR TRUCKS

Tom McCue of Galt, Ill., owner of several beds of gravel just west of Sterling, is starting the placing of auto trucks for the hauling of his gravel to Sterling. He has had several teams do the hauling, but he has been using one motor truck and says the idea is all right and he will gradually work other auto trucks into the task, instead of horses. He has just bought an auto truck and is having a body made for it. The chassis will carry three tons of sand or gravel. Mr. McCue is also having a crane made on the track so that the front end may be lifted in unloading, making expeditious work and the saving of considerable hard work. The old one is doing good work, but he is making many improvements on the new one. Other gravel bed owners are watching the outcome of motor trucks for gravel hauling, and they may buy also. The roads are perfect from the McCue gravel beds to Sterling, and they will always find roads on which they can use the trucks.

NEW CEMENT DRAIN TILE PLANT.

The Waggoner Cement Tile Company, Waggoner, Illinois, has recently placed in operation one of the largest and most up-to-date cement drain tile plants in central Illinois.

"It is our idea to produce the best cement tile on the market, and deliver tile to the trade which will be satisfactory and represent the highest value for the class of tile," states a member of the company. He also supplies the following information regarding the plant:

"We have 25,000 square feet of floor space in our plant and use the rack system and employ 10 men.

"The following tests were made by the Universal Portland Cement Company of Chicago on three 8-inch cement tile from our plant:

Length, inches	Crushing strength, lbs.
12.2	9,370
12.2	11,720
12.2	12,890
12.2	Average, 11,326

"Our tile are made of 3 parts sand and 1 part cement and it takes 11,500 pounds pressure to break one of our 8-inch tile. Our tile is made with sharp sand and the best Portland cement.

"Some of the clay and shale tile in this part of the country has been dug up and replaced with cement tile. It has been proven conclusively that drainage pays a better percentage of profit than any other investment which the land owner can make."

CEMENT TILE

Progressive men in the concrete products business have found the cement tile manufacture a profitable and satisfactory commercial enterprise.

The manufacture of cement tile is pleasant work; no disagreeable and uncertain burning and like operations. It is an exact science compared to the manufacture of clay tile. No guesswork. Cement, which is the active ingredient, is delivered, fully guaranteed and manufactured by concerns whose operations are so extensive that they can employ the highest priced scientific skill, such as individual tile plants could not afford. Manufacturers of cement tile have the best brains of the country behind them.

Tiling is just beginning. It would take one machine a year to make the product necessary to entirely tile one square mile. Cement tile are a staple article. They are always in demand and readily compete with any clay tile in any locality. The W. E. Dunn Mfg. Co., 414 24th street, Holland, Mich., manufacture one of the best cement tile machines on the market. It is a machine built on principles gained through experience in tile plants. The construction embodies every feature of advantage that perfect mechanical design can demand. In operation the Dunn cement tile machine is steady and does not cause delays for adjustments. The machine makes all sizes from 3″ to 12″ diameter.

KANSAS CEMENT MILL SOLD

The U. S. Portland Cement plant at Yocemento, Kansas, was sold by the sheriff to J. K. Mullen, the miller millionaire of Denver, Colo., for $165,000. Mr. Mullen held the first mortgage bond on the plant which was foreclosed in February. The company was organized by I. M. Yost in 1906 and a $265,000 plant was built. A small town grew up around the plant and for four years gave employment to about seventy men. It has been idle since December, 1911.

HOW CURING AT LOW TEMPERATURES AFFECTS CONCRETE

A. B. McDaniel Reports Results of Tests—Compressive Strength of Concrete Cured at 60-70 Deg. Double That at 32-40 Deg.

Of special economic importance to the contractor or the builder is a knowledge of the strength of concrete at early ages under different temperature conditions. Exact information will then replace guesswork as to when forms may be removed and what loads may be safely applied to the different parts of a concrete structure. Tests, therefore, were made at the laboratories of the University of Illinois during 1913 and 1914 and were recently reported by A. B. McDaniel, assistant professor of civil engineering at that institution, in Bulletin 81 of the Engineering Experiment Station.

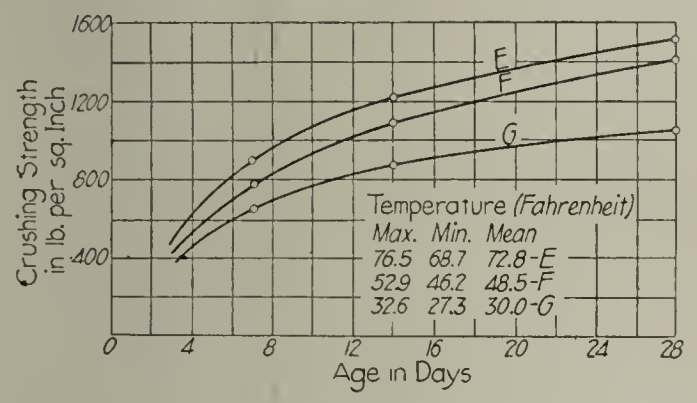


FIG. 1—STANDARDIZED VALUES FOR 6 X 6-IN. CYLINDERS OF GROUP 1

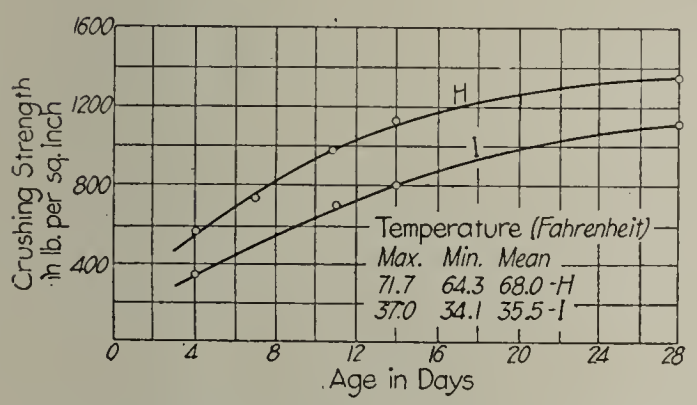


FIG. 2—STANDARDIZED VALUES FOR 6-IN. CUBES OF GROUP 2

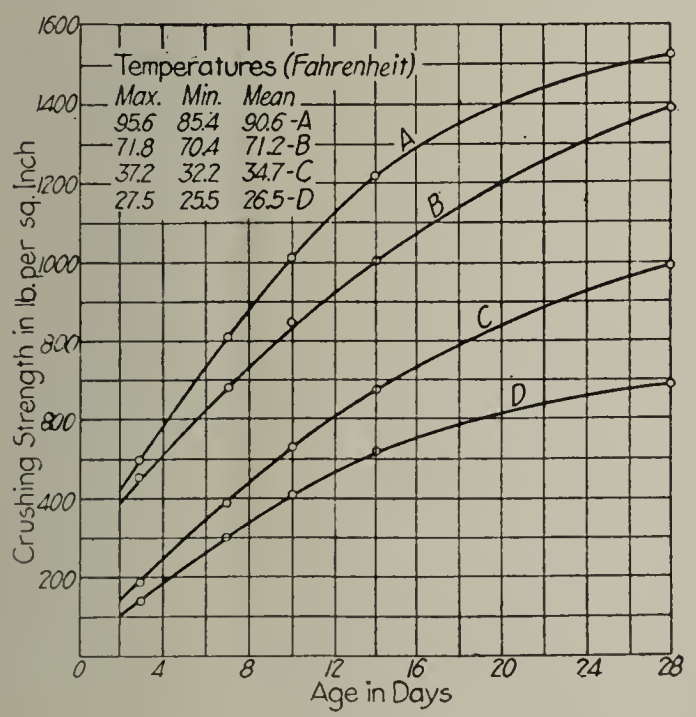


FIG. 3—AVERAGE VALUE FOR 8 X 16-IN. CYLINDERS OF GROUP 3

Three groups of tests were made—group 1, forty-five 6x6-in. cylinders; group 2, fifty-one 6-in. cubes and group 3, sixty 8x16-in. cylinders, subjected to various molding and storage temperatures. All test specimens were made with Universal Portland cement, clean, well graded Attica sand, and crushed limestone in the proportions of 1:2:4 by weight, or 1:2.2:3.6 by volume. The materials for each specimen were weighed out separately and then mixed. The temperature of the storage room was determined by daily readings of maximum and minimum thermometers. All the specimens while in storage were covered with several layers of moist sacking, which was sprinkled daily.

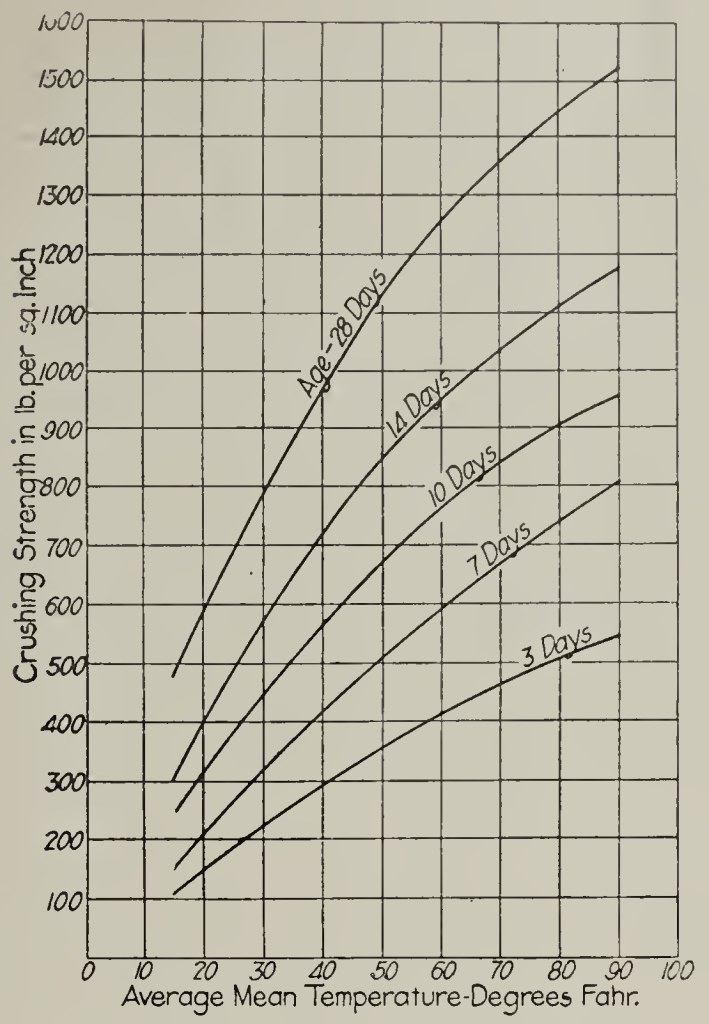


FIG. 4—RELATION OF STRENGTH TO TEMPERATURE AT DIFFERENT AGES

The specimens of group 1 were tested in about 20 hr. after removal from storage at the given temperature. The specimens of groups 2 and 3 were brought to the laboratory and tested within 1 hr., with the exception of two specimens which were stored in a room varying in temperature, as mentioned below, and kept in the laboratory at 70 deg. Fahr. for 7 days and 21 days respectively before testing.

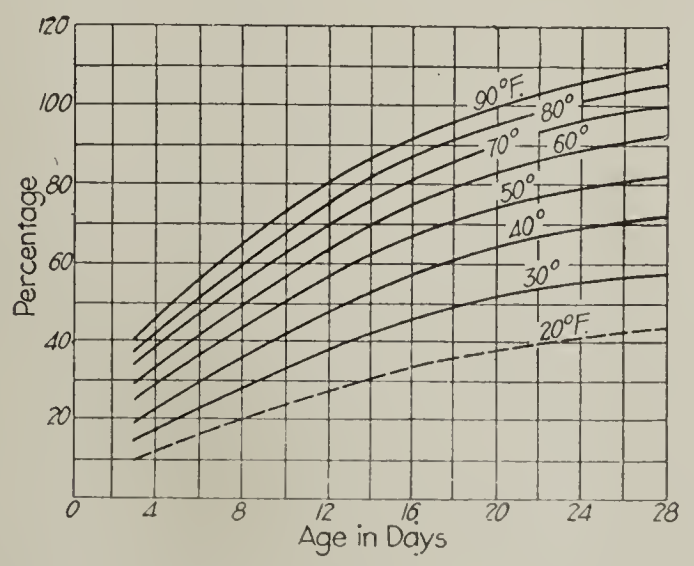


FIG. 5—STRENGTH PERCENTAGES FOR VARIOUS MEAN TEMPERATURES

Standardized Strength—Effect of Non-Uniform Temperature

The observed values for the cubes and short cylinders of groups 1 and 2 have been reduced to the equivalent strength which would be obtained for standard cylinders of height equal to twice their diameter by multiplying by 0.73, the ratio determined by the committee on specifications of the American Concrete Institute. These equivalent average values are given in Figs. 1 and 2 for the temperatures indicated on the diagrams.

The specimens of one set were stored in a room where it was known that the temperature would not be uniform. The mean temperature varied from 22 to 35 deg., with an average of 27 deg. for 42 days. All of these specimens tested at 11 days were slightly disintegrated on the surface, and those tested at 28 days were badly disintegrated. Of those reserved to be tested at 42 days only one could be tested, the other two being very badly disintegrated. These two specimens were then kept in the laboratory, as described above, for 7 and 21 days respectively. The 42-day specimen failed at 420 lb. per square inch, while the 49-day specimen (5x5x6 in.) failed at 1,270 lb. per square inch and the 63-day specimen (4x5x6 in.) at only 400 lb. per square inch. These results indicate that the low temperature retarded the hardening action of the concrete, and that the alternations above and below freezing caused a softening and crumbling of the material.

The average results for the standard 8x16-in. cylinders at the mean temperatures shown are given in Fig. 3. It is noteworthy that under a temperature slightly below freezing the concrete gained strength continuously. It is also interesting to note that the curve for a mean temperature of 26.5 deg. is substantially of the same character as that for a mean temperature of 71.2 deg.

The tests are summarized in Figs. 4 and 5. Fig. 4 shows the relation between strength and temperature for the several ages of the tests, and Fig. 5, drawn from the values in Fig. 4, shows in a general way the relation in per cent between the strength at 28 days for a temperature of 70 deg. and the strength attained at various ages under varying temperatures. These values are sufficiently accurate to furnish suggestive information which may be useful in determining the time when forms may be removed and loads applied.

General Conclusions

It is believed the following general conclusions are justifiable:

1. Under uniform temperature conditions, there is an increase of strength with age within the limits of the tests. For any temperature the rate of increase decreases with the age of the specimen, and this rate of increase is less correspondingly at the lower temperature conditions. For the specimens tested, under normal hardening temperature conditions of from 60 to 70 deg. Fahr., the compressive strength of the concrete subjected to a uniform temperature at the ages of 7, 14 and 21 days may be taken as approximately 50, 75 and 90 per cent of the strength at 28 days, respectively. For lower temperatures the percentage values are less, and for higher temperatures the percentages are higher. The relation between the percentage values at the ages of 7, 14, 21 and 28 days is nearly the same for temperature conditions from 30 to 70 deg. However, the values for the lower temperatures should be used with caution.

2. Concrete which is maintained at a temperature of from 60 to 70 deg., will, at the age of one week, have practically double the strength of the same material which is kept at a temperature of from 32 to 40 deg.

3. Figs. 4 and 5 may be used to determine the representative strength of concrete similar to that used in these tests, for various temperature conditions and for ages up to 28 days. These diagrams may be used with a fair degree of approximation to ascertain the relative strengths which concrete of ordinary practice may be expected to attain at the different temperatures.

It should be noted that generally in this investigation the specimens were stored under temperatures which were nearly uniform during the whole storage period. In one set the variations in temperature include a number of alternations above and below the freezing point, and the specimens were seriously injured. The results accord with the well known effect of freezing and thawing upon green concrete.

The tests were made under the supervision of Professor McDaniel—those of groups 1 and 2 by J. A. Anderson and W. J. Bublitz, and those of group 3 by J. A. Anderson.

TESTS ON SLAG CONCRETE

A little over a year ago the National Slag Company of 30 Church street, New York City, started a comparative series of tests on some cylinders made by the use of National Slag as an aggregate, and also corresponding cylinders using Palisade trap rock. These tests were carried on by the Department of Civil Engineering of Columbia University, New York City.

The mixture of the concrete was in all cases 1-2-4 by volume and was mixed in a Jaeger batch mixer. The Palisade trap rock was separated into ¾, ½ and ¼-inch sizes, and was artificially combined so that it was identical to that of the National slag. The sand used was Cow Bay sand, which is a typical sand for that section of the country, and the cement was a mixture of three brands, approved by the New York Building Bureau.

Tests were made at 28 days, 3 months, 6 months and 12 months. Four specimens made from each kind of concrete were tested at each age; the result being as shown in the table.

Three specimens were also tested at three months old to determine the modulus of elasticity. The specimens tested were 8x16-inch cylinders. An average value in each case was taken up to a unit load of 550 pounds per square inch with the following results: National slag showed a modulus of elasticity of 4,126,000 pounds per square inch; Palisade trap rock, 4,036,000 pounds per square inch. The average weight of National slag concrete was 140 pounds per cubic foot. That of the trap rock concrete was 151 pounds per cubic foot.

Table of Results of Ultimate Strength in Pounds Per Square Inch of Compression Tests 8″x16″ Cylinders. Averages Given in the Following Table Are the Results of Testing Four Specimens of Both Types of Concrete at Each Period

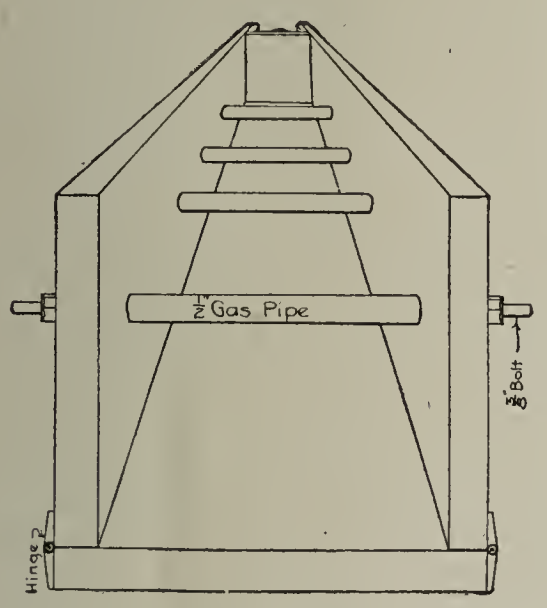
	28 Days	3 Months	6 Months	12 Months
National Slag Concrete	2465	3496	3567	4187
Palisade Trap Rock Concrete	1975	2961	3053	3537
Higher Compressive Strength of Slag Concrete	490	535	514	650
Percentage Higher Compressive Strength of Slag Concrete	24.8	18.0	16.9	18.4

GRAPE-VINE POSTS OF CONCRETE.

The grape trellis shown below was erected more than a year ago on a farm near Chalfonte, Pa. Realizing that construction designed for this purpose is always subjected to strain, the owner decided to adopt the most substantial type. This, in the long run, also meant the cheapest type. For these reasons concrete posts were selected. Concrete posts have such rigidity and strength that they can be planted farther apart than is customary with wooden posts, thus requiring fewer in number. They keep in perfect alinement and there is no decay at any point, whereas wooden posts soon rot at ground level and eventually decay throughout.

The posts were made of concrete consisting of 1 part Portland cement, 1½ parts sand, and 3 parts small stone. They are reinforced by placing in the corners of each post, about 1 inch in from the surface, a $\frac{5}{16}$-inch square twisted rod. Three-eighths-inch round rods could be used in place of square rods. The posts are 10 feet long, of which 4 feet is beneath the ground and 6 feet above the ground. They are 6 inches square at the lower end, tapering to 4 inches square at the top. Through each post five holes are provided to receive the wires, upon which the vines are trained. At the end posts the wires are fastened to eye bolts, ⅜ inch in diamater and about 12 inches long. These bolts extend through the end post and are threaded with a nut for tightening the wire. The bolts and fastenings are clearly shown in the illustration.

In the construction of the Chalfonte trellis, the slanting brace for the end post was cast in place. A notch was left in the post and the form for the brace was set up. The reinforcement of the brace projected beyond the end of the form and into the notch, the end of the form merely fitting up against the post. At the ground end of the brace an excavation was made. When the concrete was placed this excavation was also filled, thus forming a bulb or enlarged end, which answered the purpose of an anchor. The brace form was then filled with concrete, which was worked into the notch, entirely surrounding the ends



Form for Casting Concrete Trellis Posts.

of the reinforcing rods, the latter being curved at the ends to firmly anchor them. It would be feasible, however, to precast the brace, merely providing for it a notch in the post. The notch could be easily formed by nailing a triangular block to the side of the form. The post end of the brace should be set in cement mortar.

The form for casting the posts is very simple. It consists of three boards, which form a trough the exact size of the finished post. The side boards are attached to the bottom piece by hinges so that they can be readily swung down when the post is removed from the mold. The wire holes are established by placing at the proper points short pieces of ½-inch gas-pipe cut so as to fit between the side boards of the form. Through these short lengths of pipe, which are left in the concrete, are placed temporarily ⅜-inch

Concrete Post for Grape Trellis at Chalfonte, Pa. Will Never Decay or Get Out of Line.

bolts. These bolts, which also go through the side forms, serve to clamp the forms together while the pipe spaces them at the exact distance. This method of fastening is shown in the accompanying drawing. The mold should be oiled with a heavy lubricating oil before casting each post. This permits easy removal of the finished post. Under ordinary conditions the posts shown should be made at a cost of about 30 cents each. This price is as low, or lower, than the cost of an ordinary wooden post of good quality.

THE LANSING NO. 5 ROADSTER

Many a contractor doing country work has been keenly disappointed in not being able to buy just what he has wanted ever since mixers were first made—namely, a high-wheeled, wagon-tread mixer. He justly claimed that if the manufacturer of mixers had to take their machine over the rough country roads from one job to another, his needs would soon be recognized and supplied.

With this ever increasing demand in mind, the Lansing Company, Lansing, Michigan, has put on the market their Lansing Roadster, a 5-foot, split-bag machine. It has high wheels—24-inch front and 30-inch rear, that follow a wagon track. It has all the ear marks of the larger and well-known Lansing mixers, and comes equipped with either side loader or batch measuring hopper, a rotary pump, silo hoist, or folding platform. It has plenty of power, and this coupled with a minimum low weight, makes it a very desirable machine for country use.

The side loader feature is the open-end type and is said to be the first open-end skip ever put on a small side-discharging machine.

The mixer is well worth investigating, and readers are requested to write for circular 354-M and mention Cement & Engineering News when writing.

CEMENT AND ENGINEERING NEWS

(PUBLISHED MONTHLY)

WILLIAM SEAFERT, Editor and Publisher

Office—672 Transportation Building, Chicago

Telephone, Harrison 5397 Cable Address, "Seaferts" Chicago

Entered at the Post Office at Chicago, as second-class matter, July 21, 1896 under Act of March 3, 1879

SUBSCRIPTION RATES:

United States, Canada, Philippine Islands and Mexico, two years for $1.00; all other countries, $1.00 per year.

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CHICAGO, JULY, 1916

SHIPMENTS OF PORTLAND CEMENT INCREASE

Final figures on the Portland cement industry in 1915, gathered by the United States Geological Survey, confirm the estimate made on January 1, that there was a slight increase in shipments and a slight decrease in production. The shipments of Portland cement in 1915 were 86,891,681 barrels, valued at $74,756,674 in bulk at the mills; the shipments in 1914 were 86,437,956 barrels, valued at $80,118,475. The finished cement made in 1915 amounted to 85,914,907 barrels, which, compared with the 88,230,170 barrels made in 1914, shows a decrease of more than 2½ per cent.

The average factory price per barrel was 86 cents in 1915, compared with 92.7 cents in 1914, a decrease of 6.7 cents, or 7.2 per cent, in average price. According to the Survey's statement, prepared by E. F. Burchard, some of the commercial districts made a larger and some a smaller output than in 1914. Slight increases (less than 10 per cent) in output were reported from the Lehigh district and from most of the central districts; decreases were the rule in New York, Indiana, Illinois, and in the Rocky Mountain and Pacific Coast states. Increases of more than 10 per cent were made in the southeastern states, the largest increase, 20.3 per cent, having been made in the Tennessee-Alabama-Georgia district.

For those who desire the detailed statistics of the Portland cement industry by districts a tabular summary has been prepared, which may be obtained by application to the Director U. S. Geological Survey, Washington, D. C.

The shipments of natural cement in 1915 were 750,863 barrels, valued at $358,627, a decrease in quantity of 422 barrels and an increase in value of $7,257 compared with 1914. The average factory price per barrel reported for 1915 was 47.8 cents; the average in 1914 was 46.8 cents. The output in 1915 came from 12 plants, four in New York, two each in Ohio and Minnesota, and one each in Pennsylvania, Illinois, Indiana and Kansas.

The shipments of puzzolan cement in 1915 were 42,678 barrels, valued at $39,801, a decrease in quantity of 25,633 barrels and in value of $23,557 compared with the shipments of 1914, both decreases being proportionately rather large. The average factory price per barrel reported for 1915 was 93.3 cents, compared with 92.6 cents in 1914. The output in 1915 came from three plants, one each in Alabama, Ohio and Pennsylvania.

CONCRETE PIPE.

The city of Columbus, Ohio, is now doing some extensive sewer work with the use of concrete pipe. This is one of the first attempts of this city to use large sizes of concrete sewer pipe, and the success which it is having will in all probability insure the use of a considerable amount of this kind of pipe for the future.

The present improvement is in one of the new sections of the city just being opened up, and is known as the Maryland Avenue system, and includes the following quantities of pipe:

21,000 ft. of 84-in. pipe.
1,285 ft. of 60-in. pipe.
1,095 ft. of 48-in. pipe.
2,515 ft. of 36-in. pipe.
1,305 ft. of 30-in. pipe.

In addition to this there is a considerable stretch of monolithic sewer being put in, but the nature of the ground is such that the contractors are finding the work of laying the pipe sewer much more economical and this kind will probably largely prevail in the future.

The contractors who are laying the pipe are O'Donnell & Thornberry of Vincennes, Ind. The pipe is being manufactured right on the job by the Independent Concrete Pipe Company of Indianapolis, Mr. Howard Schurmann, manager of the latter company, being in constant and direct supervision of the work.

The pipe is made in steel forms, after the design and specifications of the Independent Concrete Pipe Company, the particular feature of whose design is the elliptical shape of the reinforcing. For this purpose a sheet of triangle mesh is used and is so bent that the flat portions of the ellipse come close to the inside surface of the pipe at top and bottom, while the longer diameter of the ellipse is horizontal as the pipe is laid in the ditch, bringing the reinforcing close to the outer surface of the pipe at the sides. The reinforcing is thus brought at the quarter points to the point of the greatest strain.

This pipe has a tongue-and-groove joint, with the modification of having the tongue partially cut away on the lower half of the pipe, while the lip on the other end is also partially cut away on the upper half. The openings thus left are filled with grout after the pipe is laid, making a perfectly tight joint.

The pipe has a wall thickness of one-tenth the diameter or better, and the cross-sectional area of the reinforcing varies from .125 per ft. in the 30-in. pipe to .231 per ft. in the 60-in. pipe.

The sections are made 4 ft. in length and the proportions of the concrete are 1 part of Universal cement to 2 parts of sand and 4 parts of coarse gravel, while the mortar used in sealing the joints is a 1 to 2 mixture.

The pipe or cast tongues down on cast-iron rings. The inner sections are then placed on these pallets and consist of four segments held rigidly together by clamps. The reinforcing is then placed in position and the outer steel forms set in place, these also consisting of four sections.

New Reinforced Concrete Bridge at Houston

The Concrete Foundations Rest on Reinforced Concrete Piles Cast in an Adjoining Lot. The Hand Railings Were Cast in Place in Wooden Molds.

BY J. L. JACOBS, C. E.

Franklin avenue, Houston, Texas, is the main artery leading from the business center to that portion of the city known as the sixth ward and the outlying suburban districts of Houston Heights and Brunner. It also leads to one of the principal railway passenger stations of the city. Practically one-third of the street car traffic of this city is handled on this street, and the amount of vehicular traffic is also very large. The street formerly crossed Buffalo Bayou on a through plate girder bridge of 103-feet span, carrying a double track street railway, paved between the tracks, serving for vehicles, and two cantilever sidewalks 5 feet wide. Louisiana street intersects Franklin avenue practically at right angles, and the street leading from the intersection of these two is called Fifth street. Louisiana street was carried across Buffalo Bayou on an old through Pratt truss bridge of 150 foot span with timber approaches. Both of these structures were old, and badly corroded, and totally deficient in carrying capacity for their loads.

The bayou at this point at low water stage is rather a shallow stream, about 5 feet deep; and on account of being at tidal level it becomes very stagnant at certain seasons of the year with no current whatever. The water merely changes elevation with the tidal variations in the ship channel below. Sometimes this condition of stagnation becomes exceedingly offensive, and it was therefore decided on this account and also partly on account of traffic demands, to cover up the entire bayou from the south line of Louisiana street to the north line of Franklin avenue, with a single concrete structure. This formed an irregular shaped structure with the general appearance of a triangle, but actually having seven sides. (See Fig. 1.) In the center of this structure provision is made for a future monument to General Sam Houston, the first president of Texas and one of the great men of Texan history, after whom the city was named.

The structure is of reinforced concrete of beam and girder design, paved with creosoted wood blocks resting on a 6-in. concrete base which in turn is carried by a sand fill of from 10 to 14-in. thickness. Immediately adjacent to this structure on the north, the Houston Ice & Brewing Company had already constructed a similar bridge for their own use as a driveway to their various plants. The soil on the east side of the bayou is a heavy red clay with a tendency to slide, resting on a sand stratum. In the bayou itself and on the south side the soil was bank sand, slightly mixed with clay. In the bayou and on both sides for sixty feet from the bayou the concrete foundations rest on reinforced concrete piles 20 ft. in length, the tops of the piles being 5 ft. below the natural surface of the ground at each pier. All other footings are spread footings, using the natural soil with a bearing value of 3,000 pounds per square foot. Reinforced concrete piles were loaded to eighteen tons. These piles were square in section, 10 in. at the point and 16 in. at the butt, with a specially designed head to fit the taper of the piledriver. Reinforcement consisted of four ¾ in. square bars, hooped with ⅜ in. hoops, 12 in. centers, with the exception of the top two feet of the pile, where the hoops were 3 in. on centers. The old brick retaining wall on Franklin avenue, being in good condition, was reused. New retaining walls of the cantilever type were constructed, however, at Louisiana and Fifth streets. On the west side of the bayou a continuous footing was used in the stream running the full length of the bridge; but isolated footings were used for all other construction except for the monument foundation, where a single spread footing carrying four columns was built. Ex-

Fig. 2—Driving Concrete Piles. Note Steel Derrick Used to Handle Piles and Special Follower With Cap.

cavation for all spread footings was made 8 ft. deep except where soil conditions erequired an increase in depth.

The bridge was designed to carry the following loads:—

Sidewalks uniform live load one hundred pounds per square foot. The roadways were designed for a fifteen-ton steam roller with an allowance of fifty per cent for impact. The road roller load was considered distributed over the slab on an area of 5 x 1.75 ft. for the front wheel and an area of 3 x 1.75 ft. for the rear wheels.

For beams under 30 ft. in length the live load consisted of a fifteen-ton steam roller with an allowance of fifty per cent for impact.

For beams more than 30 ft. in length and for columns the live load consisted of a fifteen-ton steam roller with an allowance of fifty per cent for impact, and in addition thereto a live load of one hundred pounds per square foot for the area supported by the beam or the column and not occupied by the roller.

For beams and columns supporting the car tracks a live load was figured the same as for other beams and columns, or a load consisting of two fifty-ton cars entrain with an allowance of fifty per cent for impact. The loading which produced the greater stress was used in each case.

Where a concentrated load was transmitted through the base of the pavement and the sand cushion, it was considered as supported by a pyramid resting on the main slab of the bridge and having its apex at the point of application of concentrated load, and the side slaps of said pyramid were considered as one-half horizontal to one vertical.

Dead loads were assumed as follows:

Reinforced concrete per cubic foot	150 lbs.
Sand	150 lbs.
Steel	490 lbs.

In designing the supporting beams for such slabs the excess loading was taken into account.

In columns reinforced with longitudinal bars only, the reinforcement did not exceed three percent nor was it less than one-half of one per cent of the effective area of columns; the effective area was considered on a diameter three inches less than outside diameter of column.

Hooped columns did not contain in excess of eight per cent longitudinal reinforcement and one and one-half per cent hooping; the effective area was considered within the hooping only. Stirrups were figured at 12,000 pounds per square inch.

No value was placed on the concrete in tension. All beams were designed as T-beams. The width of flange did not exceed one-third of the span of the beam, nor three-fourths of the distance between beams, nor twelve times the thickness of the slab. The smallest value governed in each case.

The maximum allowable unit stresses were as follows:

	Lbs. per sq. in.
Bearing, concrete on concrete	400

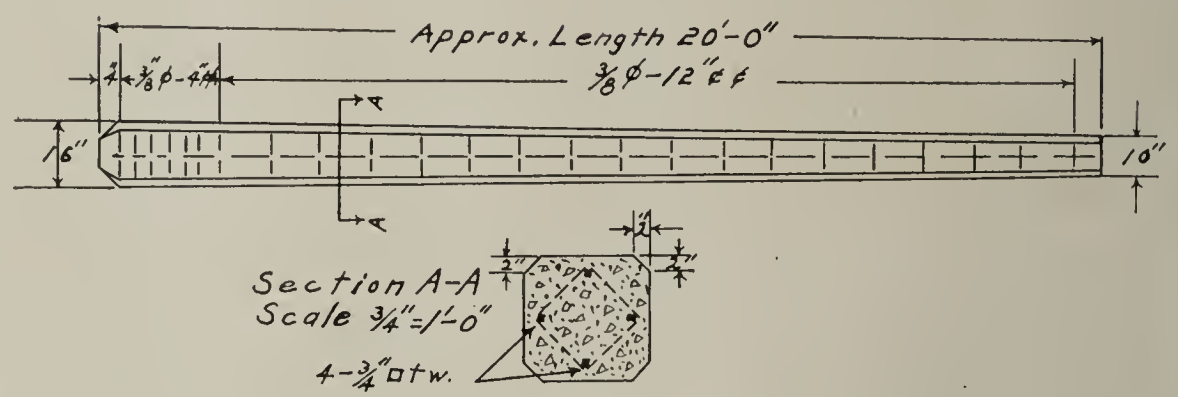


Fig. 3—Details of Concrete Pile.

Earth pressure on retaining walls was assumed as the pressure of a fluid having a weight of fifty pounds per cubic foot.

Under the roadway there was a fill provided of sand between the top of the slab and the base of the pavement, the same being 14 in. in thickness along the center line of the roadway. The space occupied by this fill was available for water pipes and conduits.

The following formulae governed the design for moments:

$M = \frac{Wl}{12}$ for continuous beams and slabs.

$M = \frac{Wl}{10}$ for semi-continuous beams and slabs.

$M = \frac{Wl}{8}$ for simple beams and slabs.

$M = \frac{Wl}{12}$ for negative moment over the supports.

Moments in square slabs reinforced in two directions were considered as equally divided in each direction. In rectangular slabs where the greater dimension was not more than one and one-half times the lesser, the load was considered as carried to the four sides, provided the reinforcement was so designed. Slabs reinforced in two directions where length was greater than breadth, load was considered distributed by the following formula:

$r = \frac{4l}{4l + 4b}$ Where r = proportion of load carried by reinforcement placed short way of slab, l = length, and b = breadth of slab.

Direct compression, massive work	400
Compression in flexure, reinforced work	700
Columns, not over 18 diameters in height, not hooped	400
Hooped columns, not over 18 diameters in height. Area of hooping not less than 1% of the vertical section, with longitudinal rods at least ½% of the horizontal section, on the area inside the hoops	500
Shearing in flexure	45
Shears on beams and slabs having web reinforcement of bent-up bars or stirrups, or both	125
Bond, deformed bars	120
Steel, medium open hearth, tension	16,000

The unit stress on steel in compression in columns did not exceed the co-existing unit stress in the surrounding concrete multiplied by the ratio of their moduli of elasticity. Under this design the columns were from 20 to 30 in. square, very heavily spiralled, and with from four to twenty-four 1¼-in. rods for verticals.

The terms of the contract provided that the Franklin avenue section should first be removed and reconstructed; that existing traffic should in the meantime be diverted to the Louisiana Street Bridge; that upon the completion of the Franklin avenue section it should be put in service, and then the Louisiana Street Bridge should be wrecked and the bridge finished.

A serious problem was incurred in taking care of street railway traffic. On account of the importance of these lines it was imperative that there be no interference with the operation of cars, and a number of schemes were proposed to take care of this condition; but all difficulties were finally overcome through the kindness of the Houston Ice & Brewing Company offering the use of their vacant property immediately adjacent to the bridge and of their reinforced concrete bridge, already constructed, for street car service. Tracks were laid across this bridge and timber approaches erected. This eliminated the street cars entirely from the site.

The pavement of the Franklin Avenue Bridge was torn up, and the rivets holding the buckle plates to

the floor stringers were cut off by means of busters and hand sledges. It was found that the floor plates, which had been heavily painted with red lead and then covered with the pavement, were in perfect condition, but that the stringers underneath them as well as the

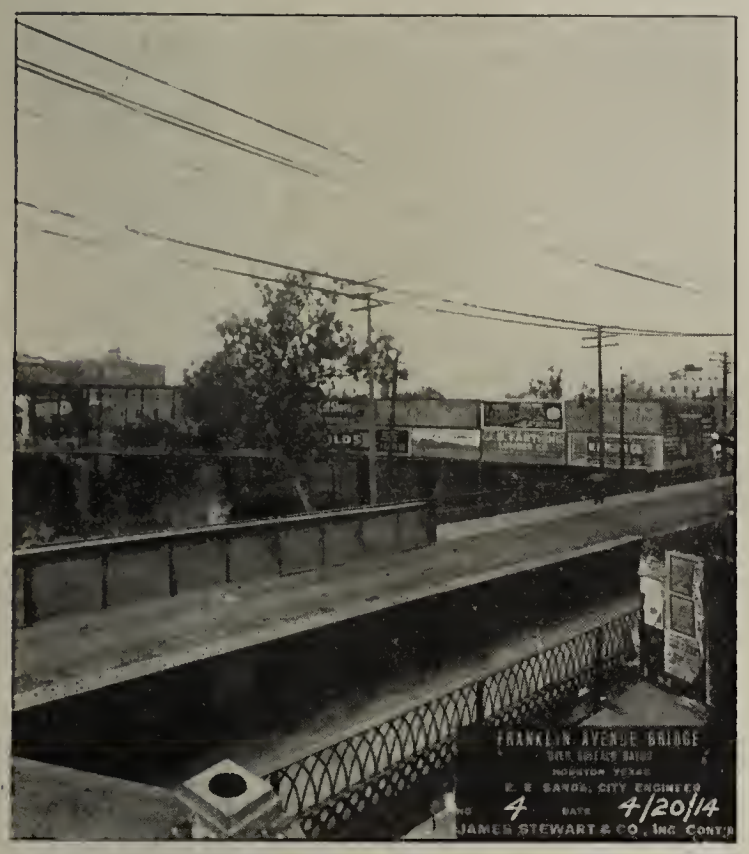


Fig. 4—Bridge Site at Start of Work. Louisiana Street Bridge in Background.

webs of the girders in connection therewith—in fact all parts of the bridge exposed to weather—were badly corroded. The girders with a 103 ft. span rested with one end on a very heavy brick abutment and with the other end on two steel shell cylinder piers, 23 ft. c. to c., filled with concrete.

A false work resting on piles was constructed underneath these girders, and a steel derrick with a 72-ft. boom was erected immediately adjacent to the girders. All connections were cut loose and the girders laid on their sides, as they were too limber through loss of weight to be moved out in single pieces in erect position. They were then cut into five sections by means of the oxy-acetylene flame, this operation requiring two days. The sections were removed by the derrick onto the approach of the bridge and delivered to the scrap man who cut them into their component pieces.

The top four feet of the bridge abutment was torn off, and the shell for the cylinder piers was removed for a distance of twelve feet, the exposed concrete then blown down with dynamite.

While this work was going on, the concrete piles were being cast in an adjoining lot. A wooden platform, approximately 25x90 ft., was built for a casting platform and the piles were made on this platform at an average rate of about twenty-two piles per working day, piles being allowed to stay in the forms forty-eight hours before being picked up and handled to storage. The steel units were fabricated entirely on a bench nearby and each day, as soon as the forms were set, the units were placed and concrete run, concrete being distributed by means of ordinary two-wheel concrete carts on runways. The piles were at first rolled out on rollers by hand, but subsequently a "Jinnywink" with a 35-ft. boom was erected and used to remove the piles and stack them properly. The date each pile was made was marked plainly on the pile in the fresh concrete. Special sheet metal caps were made to form the tops of the piles. The exterior corners of the piles were chamfered by means of corner strips in order to protect the corners from breaking. It was found that the piles would not stand driving until they were thirty days old at least.

A turn-table piledriver with 34-ft. gunwales and 45-ft. leads, equipped with a double drum hoisting engine and a No. 2 Vulcan steam hammer, with McDermid base weighing 6,800 pounds, was constructed and used to drive the false work in the river to support the forms and scaffolding. This false work consisted of timber piles spaced about 8 ft. on centers and capped with 10x10-in. timbers. The cut-off elevation of piles was + 12.5. This also served as a working platform for the pile-driver and the cofferdams and the general distribution of material. On account of the fact that the foundation piles of concrete were cut off at elevations varying from + 10.0 to — 5.0, it was necessary to design and construct a special follower with a head fitted for the driving of reinforced concrete piles. This was done as shown in Fig. 2.

The elevation of the casting yard was about + 41.0, so an incline was built of steel rails on ties running from the casting yard down to the bank of the river. The concrete piles were placed upon a light truck at the yard by means of the "Jinnywink" and were permitted to run down the hill by gravity, controlled by a snubline, to a point where they could be reached by a large steel derrick and delivered to the driver.

Immediately underneath the old Franklin Avenue Bridge a vast amount of trash was encountered in excavation, consisting of clippings from an old tin shop, broken glass bottles from the Brewery, old rusty ice cans, and in one case a hoisting engine boiler—the accumulations of many years. The driving of the concrete piles through this various rubbish was accompanied with a great deal of grief and expense, it being necessary to watch the work constantly and to evolve

Fig. 5—View of Roadway Over Complete Bridge. Note Contrast in View of Figure 4.

a new method for practically every pile. It was finally decided to use water jets in order to reduce the amount of driving. It was found that, despite a specially designed head, a softening cushion was necessary between the iron and the concrete, and, therefore, a bale of linters (cheap cotton) was purchased and a cotton cushion, consisting of a cement sack filled with cotton, was used for each pile. Piles were driven to as nearly exact grade as possible.

On the east side solid clay was incurred and the driving was very hard. The jets in many cases proved absolutely valueless and hard pounding was resorted to. It required in some instances as many as 2,200 blows to put down a single pile. Naturally we had a number of piles broken on account of such treatment, but it was readily ascertained that by cutting them off square, putting on a block of wood and then installing a new cushion we could drive them right down. It was also learned that a design of a cap which would carry support around the head of the pile for about 12 in. down from the top was of considerable assistance in preventing crushing or destruction of the head of the pile.

As soon as the piles were driven, a cofferdam of 6-in. Wakefield sheet piling, consisting of three thicknesses of 2x12-in. plank and from 12 ft. to 20 ft. long, was driven. Inside walling pieces of 6x8-in. were used. The long continuous footing—(205 ft. in length)—was concreted in four sections, all other piers having individual cofferdams except those under the Louisiana Street end of the Louisiana Bridge where three piers were included in a single cofferdam. Pumping was done by means of a four-inch Emerson Pulsometer and no difficulty was experienced in keeping the cofferdams dry with this pump. In one cofferdam the sheet piling struck an obstruction and ran a little, opening up the cofferdam, but this was readily taken care of by caulking and by banking the excavated material outside against the cofferdam. Excavation was continued to a point 6 in. below the top of the concrete piles, and as soon as the excavation was completed in any hole, the steel was placed and the concrete poured. Work on every cofferdam was carried on night and day after the work was once started until its completion. Excavation in all cofferdams was done by hand, the dirt being shoveled into buckets operated by the derrick, except in certain isolated piers, to which the derrick could not reach, where the material was thrown overboard. Forms for the superstructure were built up in the ordinary manner. The column forms on account of the height were made of 2-in. plank with 2x4-in. battens on edge and held together with standard hook steel clamps. Shores used for the very heavy girders over the river section were of 6x6-in. with heads of 3x6-in. properly braced, and these heads were made with sufficient length to permit the carrying of run plank alongside the beam sides, so that the men could work easily. Also soffits for the heavy girders were made 3 in. in thickness, to prevent deflection between shores. All large girders were given a camber of 2½ in. in their length and the smaller ones cambered in proportion. The principal difficulty in the form work consisted of taking care of the expansion joints, there being two such joints, one joint having a deep expansion girder on which the beams rested, the bearing consisting of two sliding steel plates between which were placed two zinc plates each 1/16 in. thick, with a heavy coating of mineral grease between. The other expansion joint at the bayou section was made over the line of columns resting on the continuous footing, the beams bearing on individual brackets at each column with plates as before, and the top section of the column for the beam bearing being split in half so that the bearing of the sliding beam was partly on the column and partly on the bracket. The nature of these bearings rendered it necessary to concrete the two outside sections and then to fill in the intermediate section in order to support the ends of the beams of the intermediate sections, and caused some considerable complications in the work. The slab forms were all made of 1-in. boards, dressed, resting on 2x6-in. and 2x8-in. joists, the depth of joists being selected in proportion to the span which they had to carry. It was figured to re-use all lumber twice. For sheathing, plain square lumber was used, it having been found that best results both in erection and wrecking are obtained in this way, rather than by the use of tongue and grooved lumber.

The handling of reinforcing steel was a very complicated matter. It ranged in size from ¼ in. to 1¼ in. in diameter, and in length from 3 ft. to 70 ft. On account of the irregular shape of the bridge there were 1,565 items of steel in the list. The lot used for casting the concrete piles was cleared and converted into a steel yard, and the steel was assorted as it was received. For convenience the various details of beam construction were all cut to uniform size, approximately 3x12 in., from cloth blue prints, and bound into a book. This made a volume easy to handle and available for ready reference, both at the bending table and in placing the material. The bending of the stirrups was done by a specially designed machine whereby a stirrup was bent in two motions, and the heavy bars were all bent by means of standard bar benders. Each bar was tagged with its beam number on a cloth tag as soon as it was bent, so that it could be readily found and delivered. The stirrups for each beam were bundled and tagged. All steel was placed by common labor. Beveled concrete spacing blocks were used to hold the steel up from the bottom of the beam and slab, and also to hold the various bars in each beam apart.

A crushed blue sandstone was used for concrete aggregate with San Jacinto River sand.

A working platform between the two bridges was built of 3-in. plank, and underneath this platform a bin holding approximately twenty yards of rock and ten yards of sand was constructed. This bin was fed by means of openings cut in the floor of the platform. These bins were equipped with steel gates of standard form, which discharged into a measuring hopper, which in turn discharged into a ¾-yd. Boss mixer, made by the American Cement Machine Co., Keokuk, Ia. There was a platform constructed just over the mixer at the measuring hopper for the operator and the cement man. The cement was sent down in a chute from the cement house to this platform where it was opened and dumped into the measuring hopper with the rest of the batch. Material was delivered onto the working platform above in Western dump wagons and dumped as close to the bins as possible, but with the necessity of quick movement of teams in and out from the site, it was found most economical to have them dump where they could and get away, and the material was dragged to the bins as required by means of an ordinary slip scraper operated by a line from the hoisting engine. This slip scraper operation required three men, two on the slip and one on the winch-head of the engine to operate. The mixed concrete discharged from the mixer into an automatically dumping hoisting bucket, which in turn discharged into the floor hopper of the Insley type, whence it was drawn into two-wheel concrete carts and wheeled to place. By means of this plant a speed of thirty yards per hour was maintained while in operation. As soon as it was found necessary to remove the working platform, material was delivered to the bins from storage located a short distance away while the material platform was torn out. When the concrete slab occupying the position of the working platform was in place, the operation was resumed as before. After the entire concreting was completed, the hole occupied by the hoist and bin feed was filled in.

The operation of constructing the bridge was carried on without accident and almost without incident until the final gap of concrete was to be poured. Then with all forms in place and the steel set, ready to concrete,

a rain of 7.4 in. in two hours occurred on the night of the first day of December, 1914, raising the river twenty feet, carrying out the form work, and, in the course of the flood that ensued, knocking out the shores from under the main river spans, some of which supported concrete not over eleven days old for spans of 55 ft. in length. No measurable deflection, however, ensued. A delay of two weeks to the entire job occurred and required the rebuilding of the forms, but no other material was lost.

In constructing the cantilever sidewalks the main carrying girders were first poured and the bottom part of the cantilever beams. The top part of the beam, the curb in connection therewith, and the sidewalk, including the finish, were all placed in one operation, making a monolithic part of the structure.

Forms were made for the pedestals of the hand-railing in sections, so that they could be reused. The balusters, being of a spindle variety, were cast in plaster-of-Paris moulds away from the site and hauled to the site when needed. The top and bottom railings were cast in place in wooden moulds, the top being finished with a cement finish. In making this railing a fine flint gravel, with no particle larger than ½ in., was used without any sand. The result is very satisfying, the grain of the gravel clearly showing, whereas the spindles are very smooth in texture and nearly white, affording a pleasing contrast.

As soon as all concrete was poured and the public service corporations had completed their work, the sand fill was laid and finished to proper grade. Over this the concrete paving base was put on in the ordinary fashion, and the creosoted wood blocks installed over the base after being down a week. In order to take care of the expansion in the pavement it was decided to lay blocks first in the gutters draining to the central circular monument plot and make joints 2 in. wide for expansion on each side of the gutters. A sand and cement base course of about one part cement to three parts sand was first laid about one-half inch thick; the blocks were then laid upon the sand, the sand being first sprinkled with water from a sprinkling can. After this the blocks were laid very rapidly and inspected; the spaces were then filled with asphalt filler and the surface gone over so as to work the filler down between the blocks and to cover the surface with the asphalt. The whole was then rolled and covered with sand, and traffic turned over the bridge immediately after the blocks were laid.

The lighting of this type of structure is very important. A pleasing effect was obtained by the cast iron standards adopted, placed at the curb.

The following quantities of material were used:

485 concrete piles, 20 ft. long.
5,000 cu. yds. of concrete.
405 tons of reinforcing steel.
49,000 ft. B. M., form lumber.
4,000 sq. yds. of paving blocks.

The work was started on April 22nd, 1914, and the Franklin Avenue section was completed September 20th. Work started on the Louisiana Street section October 1st, and the entire bridge was completed and traffic turned over it on January 10th, 1915.

The bridge was designed by E. E. Sands, City Engineer; E. A. Fretz was Resident Engineer, in charge of construction for the city; James Stewart & Company, Incorporated, were Contractors, with E. F. Hoffman as Job Superintendent, and the writer as Manager for the Company for the Southern District.

Robert F. Hall, who was manager of publicity for the Universal Cement Co., is now a member of the staff of the Portland Cement Association.

CONSULTING HIGHWAY ENGINEER FOR CEMENT MANUFACTURERS

A news item of particular interest to highway officials, engineers and others concerned in the betterment of public highways, is to the effect that A. N. Johnson, recently with the Bureau of Municipal Research, New York City, has been tendered and has accepted the position of Consulting Highway Engineer for the Association of American Portland Cement Manufacturers. It is needless to say that Mr. Johnson's wide experience and well known ability will become a valuable factor in the promotion of permanent roads. Mr. Johnson may properly be called a pioneer in this type of construction, in which he took particular interest while State Highway Engineer of Illinois, which office he held for eight years. At the International Road Congress held in London some years ago, Mr. Johnson presented a paper on the subject of concrete roads. He was among the first to point out the necessity of standardizing practice with reference to efficiency as opposed to indiscriminate and superficial methods.

Mr. Johnson's experience in highway construction in general will be of direct service in concentrating his efforts upon a particular type of road. During the past year he has been compiling a digest of the road laws of all states, this work being done for the Rockefeller Foundation. The following is a brief summary of his work: He is a graduate of Harvard University, and in company with Logan Waller Page and A. B. Fletcher, took the first course in highway lectures offered in this country by the University. He is an honorary member of the Association of State Highway Officials; at one time Third Assistant Engineer, Massachusetts Highway Department; State Highway Engineer of Maryland for seven years, and for a period of one year Chief Engineer U. S. Office of Public Roads.

ANOTHER USE FOR CONCRETE

One of the newest use for concrete is safes or filing cabinets for storing valuable papers in offices and commercial houses. Its advantage over steel is that it is absolutely fireproof. A number of cases are upon record of papers being reduced to ashes in a steel safe which had apparently stood the heat without serious damage. But the high temperature had penetrated the walls and destroyed the papers within.

Concrete safes are not burglar proof, as they can be readily blown up, but they are much cheaper than steel. Their construction is not a simple matter, because they must have the minimum thickness capable of sustaining the bolts, hinges and locks in order that their weight may be as small as possible.

The fire at the Edison plant at East Orange demonstrated the feasibility of the concrete safe, as some papers left in concrete cabinets built into the walls were found in perfectly good condition.

Concrete safes in small sizes are being made for the fireproof storage of deeds and other valuable documents. They are designed to be placed inside of the large steel safe supposed to be burglarproof.

NEW CEMENT PLANT IN OPERATION.

The Cayuga Cement Corporation, of which J. G. White, of one of the largest engineering organizations in the world, is president, and J. G. Bergquist, of Universal Portland Cement fame, is a director, has begun operating its factory at Portland Point, N. Y. With an equipment selected by men of such great experience and ability, economical production should be assured.

SECURITY CEMENT PLANT INCREASING CAPACITY

The Security Cement & Lime Company, Hagerstown, Maryland, is completing extensive improvements to the cement mill started last summer. These will cost in the aggregate about $100,000, and will increase the daily output to about 2,800 barrels. The new work will include the addition of one 8x125 ft. kiln, a system of storage tanks for the ground raw mix, a traveling crane installation for handling the material to and from the clinker storage and additional grinding mills on the raw end, together with all necessary conveying machinery and accessories.

Four new steel tanks were built for storing the ground mix, these having a capacity of 1,500 barrels each and enabling the ground raw materials to be thoroughly tested and analyzed before entering the kiln, thus insuring a thorough check on the raw material and a greater constancy in a uniform product.

A large electric traveling crane has been installed at the clinker storage, which enables this department to be handled with much greater efficiency.

The clinker as it comes from the kilns is carried by bucket conveyors and dumped into the storage yard where water is kept constantly sprinkling upon it. The electric crane, with a huge grab bucket having a capacity of 15 barrels, transfers the hot clinker for storage and curing purposes and on the return journey picks up some of the cold stored clinker and deposits this in a central tank, from which it is carried by belt conveyors to the grinding mills on the finishing end.

This clinker storage has a capacity of 50,000 barrels and was made of this size to allow ample time for thoroughly curing the clinker before grinding it, as experience has proven this gives a better cement product.

The various improvements to the cement plant were made under the supervision of F. H. Lewis, consulting engineer, Birmingham, Ala.

SELF-PROPELLING WAGON AND TRUCK LOADERS

The Jeffrey Manufacturing Company, of Columbus, Ohio, manufacturers of elevating, conveying, crushing, screening and power transmission machinery, have just received from the press their latest Bulletin No. 177 featuring their self-propelling wagon and truck loaders for handling crushed stone, sand, gravel, clinker, coke, etc.

These machines have a capacity of 1 to 1½ cubic yards of material per minute, will load crushed stone maximum size pieces through 3½-in. ring, and will load trucks or wagons in 3 or 4 minutes, saving the wages of from 2 to 5 shovelers.

The self-propelling device enables one man to operate the loader as it is fed into the pile, and move the machine about under its own power.

These loaders are driven by 5 H. P. I. motor or 6 H. P. gasoline engine. The type "A-15" loader is built with a collapsible elevator, which makes it available about all parts of the yard and easier to operate over rough ground; also permits it to be used where low sheds, trestles and other overhead obstructions are encountered.

The bulletin contains illustrations of many interesting installations, specifications, prices and complete details of their different types of loaders. A free copy can be obtained by anyone interested by writing to the factory office of the Jeffrey Manufacturing Company, 914 North Fourth Street, Columbus, Ohio, or to any of their branch offices.

DU PONT PRODUCTS

Du Pont Products is the title of the latest publication issued by E. I. Du Pont de Nemours & Company of Wilmington, Delaware. This book describes in detail and gives the uses of 251 different products manufactured by the Du Pont Powder Co. and companies affiliated with it, for instance, the Du Pont Chemical Co., the Arlington Co., the Du Pont Fabrikoid Co. and others.

We learn from it that the usefulness of this concern extends far beyond the manufacture of explosives. Chemical products of various kinds, as well as celluloid and imitation leather products, which are found in every household, all originate from one or another of the Du Pont factories.

Every factory in the country, no matter what it produces, every chemist, every hospital and almost every farmer uses Du Pont products in one form or another and all automobile owners, book binders and furniture dealers are interested in Du Pont products.

"Du Pont Products," therefore, will be found to be a handy book of reference and will place the reader in a position to widen the scope of his trading with the Du Pont Company by suggesting to him, that he may just as well secure from the Du Pont factories a dozen more articles, in addition to the one he may be accustomed to purchase from the company so far.

SMALL CONCRETE MIXERS

Believing that what the trade wanted was a dependable concrete mixer that would handle an ordinary sized batch of 5 to 6 cubic feet, give a reasonable daily output at a saving of time and labor, the Jaeger Machine Co., 212 W. Rich street, Columbus, O., produced its Big-An-Litle mixer, described in a catalog giving full details as to the machine and showing it in use. The mixer has been so successful, the manufacturer states, that it was found necessary to add a larger model of the same revolving tilting drum type. A special spouting equipment for eliminating all labor possible in the placing of mixed concrete in forms on such work as foundations, piers, abutments, slabs, etc., has been put out for use with the mixers. Pavers and other extra equipment features are described in the literature. "A Mix a Minute" is the company's slogan, and is said to have been proven by the machines in service.

EDMONTON CEMENT MILL TO BE REMODELED

J. R. Patterson, formerly general manager Peerless Portland Cement Company, Union City, Mich., is now located at Marlboro, Alberta, Canada, as vice-president and general manager of the Edmonton Cement Company, Limited. Mr. Patterson has succeeded in financing this company, and will remodel the mill, changing it from marl to rock and doubling the capacity. In making this change they will install considerable machinery; among other things will need a 100-ton steam shovel and a rock dryer 7 ft. in diameter and 80 ft. long.

NEW OFFICERS FOR CEMENT COMPANY

William P. Corbett has been made vice-president and J. W. Kittrell general manager of Alsen's American Portland Cement Works, New York City.

MILLS OF THE SANDUSKY CEMENT CO.

Bay Bridge, Ohio, Plant.

Syracuse, Indiana, Plant.

Dixon, Illinois, Plant.

York, Pennsylvania, Plant.

BRIEF HISTORY OF THE SANDUSKY CEMENT CO.

Organized in 1892 with a small plant at Bay Bridge (near Sandusky), Ohio, with a capacity of 200 barrels of gray Portland cement per day, the Sandusky Cement Company has gradually increased its output and erected new factories, resulting in the present production of over 6,000 barrels daily, with mills of the most modern type located at Bay Bridge, Ohio, Syracuse, Indiana and Dixon, Illinois.

The trade name "Medusa" was very appropriately adopted, Medusa being the earliest known maker of artificial stone, according to Greek mythology, and on account of the wide experience in the cement business of those in charge of the mills, the constant expert chemical analyses of the raw materials entering into the manufacture of the product of the Sandusky Cement Company, and the policy of the officers and directors to install up-to-date approved machinery at all times, the word "Medusa" became a synonym for quality as well as service.

Experiments made by S. B. Newberry, President and General Manager of this company, and formerly Professor of Chemistry at Cornell University, finally produced Medusa White Portland Cement, which was patented October 13, 1908, and a special factory was built at York, Pennsylvania, for the manufacture of this product. The high quality of Medusa White is attested by the fact that the United States Government, after many tests, is using it almost daily in the construction of post-offices and other public buildings, while the English, Canadian, Australian and other foreign governments are also using Medusa White Cement extensively for important work.

Medusa Waterproofing, also invented by S. B. Newberry, was patented in 1907, and is being manufactured in powder and paste form at the Bay Bridge plant. This is the original concrete waterproofing material, and its use insures perfect and permanent water-tight and damp-proof results.

To meet the demand of architects and engineers, Medusa Water-proofed Gray and Medusa Waterproofed White Portland Cement are also being made at the various factories, consisting of Medusa Water-proofing powder ground scientifically in the process of manufacture with ordinary Medusa Gray and White Cement.

That Medusa products are internationally recognized is shown by orders received for White Cement and Waterproofing from Canada, Mexico, Central America, West Indies, almost all countries of South America, England, Austria, Russia, Spain, Portugal, Holland, Dutch East Indies, China, India, Egypt, Palestine, Australia, New Zealand and South Africa.

Recovery of Potash at the Security Cement Plant

Through the progressiveness of the officials and board of directors of the Security Cement & Lime Company, a potash recovery plant is being built at its cement plant at Security, near here, which gives every

Erecting Frame Work, Potash Recovery Plant.

promise of opening up an important source of potash supply.

It is conservatively estimated this plant will recover approximately four tons of potash daily, and it is said that if similar systems are adopted by all of the cement plants of the country capable of using it, they would furnish approximately 100,000 tons annually, or about 40 per cent of the amount imported yearly from Germany in normal times.

The Security recovery plant, which is rapidly nearing completion, will be watched with the greatest interest, because its success means not only the recovery of a valuable by-product from cement manufacture and a consequent goodly return on the investment for such a plant, but what is of vastly greater importance—the partial freeing of this country from absolute dependence upon Germany for its potash supply.

The success of this plant will also have a determining influence upon the selection in the future of the raw materials used in cement manufacture, for the natural tendency will be to secure those materials that have a large potash content, with the knowledge that a good part of this will be liberated in the kilns and precipitated in the recovery plant.

It has been known for a long time that there was a small amount of potash in limestone rock. It has also been known that a certain amount of this potash is given off in the cement kiln gases. No definite information was available on this, however, until about a year ago.

When the price of potash began soaring, the Security Cement & Lime Company became more or less interested in potash recovery from the kiln gases. At that time the company did not realize that the amount which could be recovered would be sufficient to make the proposition an attractive one; nor was it known that there were any available means for recovering it. Nothing was done in the matter until September, 1915, when Vice-President Porter of the company, on a visit to the Exhibition of Chemical Industries in New York City, obtained definite information that led him to believe apparatus was available for recovering potash from kiln gases at less cost than was supposed.

The Western Precipitation Company, of Los Angeles, Cal., control, in so far as this applies to cement mills, a method for this purpose, known as the Cottrell electrical precipitation process.

Knowing that the raw materials of the Security Company contained an exceptionally large amount of potash, Mr. Porter took up with his board of directors the question of installing apparatus to recover it, and was authorized to further investigate the matter. Mr. Porter went to California to study a plant equipped with this process, and upon reporting the result of his investigation, he was authorized by the board to construct a similar plant at Security.

This process was developed by Professor Cottrell, while professor of chemistry at the University of California, and is essentially for the precipitation of solid particles from gases and is an electro static process. It is based upon the same principle as the old pith ball experiment, which is familiar to all students of elementary physics. The Cottrell process was first applied to metallurgical plants in the West for the precipitation of various kinds of metallic fumes, such as arsenic, lead, etc. It is also applied to the precipitation of sulphuric acid mist.

The Riverside Portland Cement Company, located 30 to 40 miles from Los Angeles in the heart of an important orange grove section, was threatened with injunctions and other legal difficulties on account of the dust thrown from the plant. It was being claimed by the orange growers that this dust had a deteriorating effect upon the groves. The company first attempted to solve the matter by buying all adjoining property that might be affected; but when it was found that this land was worth approximately $1,000 an acre, it was soon ascertained that this would prove too expensive.

The company then began experimenting with the Cottrell process for the prceipitation of the dust which passed from the kiln stacks, and after overcoming many difficulties natural in developing a new process, it was

New Clinker Storage at Security Cement Plant.

at last worked out in an entirely successful manner.

At the present time the amount of dust coming from the plant is almost negligible. The dust passing off from the cement kilns consists partly of finely ground particles of rock which are blown over by the current of gases and partly a fume of potash and sodium salts. Potash and soda, which are in the raw material, are driven off in the form of gas by the intense heat in the

lower end of the cement kilns. As this gas reaches the upper and cooler end of the kiln it condenses into very finely divided solid particles, in other words—fumes.

The installation at the Riverside plant was primarily made for dust collection and at the time they did not know that any potash was present, but later discovered it in a fairly good proportion.

Since the outbreak of the war the Riverside company has been able to contract for the sale of this material at prices which gave very large returns on the original investment of the dust-collecting equipment, and this in spite of the fact that their raw materials contain a very small percentage of potash.

The process is said to have gone beyond its experimental stages for metallurgical uses, and for this work is thoroughly established. It is only experimental in regard to the recovery of potash.

The recovery plant which is now nearing completion at the Security Company is a compact one, being about 35x70 feet and 65 feet high. It is of steel frame construction, covered with sheet steel plates, requiring altogether about 180 tons of steel, and is built on heavy concrete foundations. This building is called the treater plant. Dampers are placed at the top of each of the five kiln stacks and direct pipe connections are made from these stacks to a gooseneck pipe which

Foundations for Blowers, Potash Recovery Plant. New Raw Storage Tanks in Background.

leads to the top of the treater building, this bringing all the gases at one point at the top of the building.

In the upper part of the building, at regular intervals, are placed vertically 800 sections of steel pipe 16 feet long by 12 inches in diameter. Through the middle of each pipe is suspended a wire which is to be charged with electric current of 60,000 to 70,000 volts. This current produces an intense electrical field in the pipe and the effect of this field is to drive all solids in the fumes to the sides of the pipe. The pipes are arranged in two parallel sections, each section containing 400 pipe. About once an hour the gas is shut off from each section of the treater in rotation and the pipe is slightly rapped mechanically to shake the accumulated dust down into steel hoppers below. The gas passes through dampers in the sides of the collecting hoppers and is drawn out by exhaust fans while the dust accumulates in the hoppers.

The bottom of the hoppers are arranged at an angle allowing the accumulated dust to be fed through a spout to belt conveyors which carry it to an adjoining building where it is packed for shipment.

This process does not interfere in the slightest with the ordinary methods of making cement, except mechanical draft is substituted for natural draft.

In the operation of the Riverside Portland Cement Company's plant it was shown that the current required was extremely small, because this process does not consume large volumes of current, as there is no return wire. There is, of course, a certain amount of current lost through leakage.

The plant is almost entirely mechanical in its operation and based upon conservative figures it is estimated that the total cost will not exceed $20 per day for labor, maintenance and power at the plant which the Security Company is erecting, this being a five-kiln plant with 2,600 to 2,800 barrels of cement a day.

The raw material of the Security Company contains slightly over one per cent of potash or potassium oxide. The percentage of total potash volatilized in the kilns varies all the way from 30 to 60 per cent. It is of course possible that after this process is put into more use a method can be devised to volatilize an even larger percentage.

It is estimated that the Security plant will recover at least 80 per cent of the potash passing through the treater and that this will give the company a production of approximately four tons per day, although it is possible this will vary and an increased production will be obtained after the plant has become fully adjusted and certain experiments in operation are more fully worked out.

The Security plant now uses about 800 tons of raw material per day and this contains a total of 8 tons of potash which passes through the kilns. It has been found that the potash is driven off principally in the form of sulphate, with a small amount of carbonate.

This plant is being constructed under plans furnished by the Western Precipitation Company, and under the direct supervision of the cement company's engineer.

MANY ORDERS FOR GRIFFIN MILLS

The Bradley Pulverizer Company of Boston recently made another consignment of Giant Griffin Mills to the National Cement Company, Caracas, Venezuela. This is a repeat order as this company started using the Giant Griffin Mill two years ago and have now replaced all of their grinding machinery with this type of mill.

The Bradley Pulverizer Company have also made some very large shipments of mills to such people as the Lehigh Portland Cement Company, Allentown, Pa.; Clinchfield Portland Cement Corp., Kingsport, Tenn.; Standard Portland Cement Company, Leeds, Ala.; Lawrence Portland Cement Company, Siegfried, Pa.; and in addition to this have exported a great many mills to England.

The success of the Giant Griffin Mill lays in its ability to produce material 82% to 83% through the 200 mesh screen at an extremely low cost both from maintenance and horse power stand-point.

The above mentioned companies who have recently bought mills were former users which shows conclusively that wherever the Giant Griffin Mill or Bradley Hercules Mill are used they are giving success.

It is a known fact that the Giant Griffin Mill has always been able to meet the cement specifications and in fact has always beaten them from two to five points. The new specifications which go into effect January 1, 1917, are quite severe but with the new type Giant Griffin Mill which has just been offered for sale, the Bradley Pulverizer Company anticipated this change in the cement specifications and are in position to meet all demands.

GRAVEL COMPANIES IMPROVING PLANTS

Mr. V. O. Johnston, president of the Lincoln Sand & Gravel Company, Lincoln, Ill., writes as follows: "We beg to advise that we just installed a new centrifugal pump at our plant. We purchased this pump from the Morris Machine Works, Baldwinsville, N. Y.

"It is one of their sand and gravel pumps, 10-in. suction and discharge, with impeller, liner and plates of manganese steel.

"We have used these pumps for years and find them exceedingly satisfactory for heavy duty.

"It may interest you to know that the Barry Sand & Gravel Company, located at Barry, Ill., on the Wabash Railroad, of which concern I also happen to be the head, has just completed the installation of a dredge equipped with a 10-inch pump from the Morris Machine Works and a 200 H. P. Allis-Chalmers motor. The plant consists of this dredge, gravity screens and crushing outfit, which will have a capacity of from 25 to 30 cars per day.

"The Sabula Sand & Gravel Co., Sabula, Iowa, located on the C. M. & St. P., of which company I also happen to be owner, has just completed the installation of a dredging outfit equipped with a 10-inch heavy duty pump and double engines also supplied by the Morris Machine Works. This pump is operated by 125 H. P. boiler and has a capacity of from 20 to 25 cars per day."

FREIGHT RATES ON GRAVEL

The Chamber of Commerce, Norfolk, Va., has entered a protest against the increase in freight rates from Masaponax, Va., to Norfolk on gravel originating at the former point.

When the Corporation Commission recently notified the Chamber that the Norfolk & Western had applied for permission to increase the rate from 70 cents to 85 cents a ton of 2,000 pounds, Secretary Cox notified everyone in Norfolk who, he thought might be interested.

Among the strenuous protests received are several which came from Norfolk county or contractors having county contracts. It having appeared from the communications that the gravel in question is an unwashed sort, mixed with clay and sand, the Chamber is asking a continuance of the present rate on this grade, although not objecting to an increase on clean gravel.

Chairman G. Taylor Gwathmey, of the county road board. is one of the complainers over the proposed increase and F. J. McGuire, a local contractor who has just closed a contract with the county, wants to know why, if the rate is not remunerative, should the railroad have so earnestly solicited the business while he was bidding on the road work. The rise contemplated would impose an additional cost of nearly $1,000 on this contract.

Several local men left recently for Richmond to appear in opposition to the change. Chairman Gwathmey, of the road board, sent a letter expressing the views of himself and associates.

FREIGHT RATES ON GRAVEL

The J. B. Blanton Sand Company, of Frankfort, Ky., filed a complaint with the State Railroad Commission against the freight rate on sand from Lexington to Frankfort. The company alleges that it has been paying a 70 cent rate from Lexington to Frankfort, which is the same rate from Lexington to Louisville. The Louisville & Nashville Railroad Company agreed to reduce the rate to 60 cents.

FREIGHT RATES ON GRAVEL

Advanced freight rates on sand, stone and gravel which were to become effective June 1 on all Texas roads, with the exception of a half dozen counties, have been suspended until September 1. This information was contained in a telegram received by Charles Bland, traffic manager of the Chamber of Commerce, from the State Railroad Commission. When the order for advanced rates on this material was promulgated some time ago, Beaumont, Paris and Mineral Wells, Texas, were excepted because of unusual building activities in those cities. Beaumont obtained the old rates on material shipped for construction of her municipal wharf. Pressure was brought to bear from other parts of the state, however, and as a result the railroad commission has passed an order holding up the increased rates until September 1. The old rate will apply over the state until that date.

This decision will be of benefit to Beaumont, as while the old rate was retained on material shipped for use in construction of the city wharf, merchants and contractors were to have been compelled to pay the increased rate, which was considerably higher. Because of the unusual building activity here, this will effect a big saving to contractors and owners putting up new buildings.

FREIGHT RATES ON GRAVEL EXCESSIVE

Rates charged on sand and gravel over the New Orleans, Texas and Mexico Railroad were found to be excessive by the Louisiana Railroad Commission, Baton Rouge, and the new rates that became effective March 15 are much lower, ranging from 1 cent to 4 per 100 pounds over from 25 to 250 miles of traffic. In this case the commission further ordered that in case the New Orleans, Texas and Mexico charges higher rates on sand, gravel, shells and crushed stone over its lines than any other railroad in the state, except where it meets competition with the Texas and Pacific at Anchorage, La. It has, however, been the custom of the Frisco lines to make special rates on the commodities when they are to be used for public improvements.

DROP IN GRAVEL FREIGHT RATES

The reduction of freight rates on gravel granted by the Louisiana Railroad Commission at a hearing held in Baton Rouge last month is of interest to the parish of Ouachita in that the police jury at its last session the past week created two road districts east of the Ouachita river and as the furthest point of this road is little beyond the twenty-five mile limit from the gravel supply, the new rates adopted by the railroad commission on Tuesday will mean a saving of thousands of dollars to the parish of Ouachita in freight charges on hauling the necessary gravel. Rates on gravel for road purposes for a twenty-five mile haul formerly was $12 per car and now reduced to $8 per car for the same distance, which means a saving of approximately $400 per mile in gravel road construction. In the case where the haul is from 25 to 75 miles the new rate is $12 instead of $16, the former rate charge, and a saving of from $200 to $300 per mile in road construction.

1916 REVISED DIRECTORY OF CEMENT PLANTS

The American Cement Directory for 1916, issued by the Bradley Puverizer Co., Allentown, Pa., is being distributed. It is a valuable little book to anyone interested in the cement industry and to all those so interested, it is sent free by the Bradley Co.

PORTABLE CLAM SHELL TRACTOR FOR UNLOADING CARS, DIGGING DITCHES, SEWER BACK FILLER, ETC.

The portable steel clam shell tractor illustrated on this page is manufactured by John F. Byers Machine Company, 260 Sycamore Street, Ravenna, O. It is a valuable machine for contractors, material yards, coal yards and industrial plants for unloading cars, digging ditches, sewer back filler, etc. Entirely one man control. Does work of twenty men. It is shipped entirely set up, boom complete and ready to work; is easily shipped from job to job by rail or street, as its size comes entirely within railroad and highway clearances and within all city and county overhead clearances. Will travel most any place a motor truck will go. Spots cars by means of winch head. All operations by power; bucket control, boom swing and peaking, two way traction, large traction wheels, adjustable folding outriggers, etc.

CONCRETE GUARD RAIL

The Concrete Products Company, 803 Diamond Bank building, Pittsburgh, Pa., had an interesting exhibit of reinforced concrete guard rail for highway work, and reinforced concrete culvert pipe, at the annual Good Roads Show.

Western Dump Wagons

Outrank All Others

They appeal to the buyer who is looking for service. Their **LIGHT** and **STRONG** construction is greatly appreciated by men who have tried others. The Western is the recognized high class wagon. It possesses every good feature of a strictly up-to-date wagon. This space is too limited to tell the many good features. Better write for our catalogue.

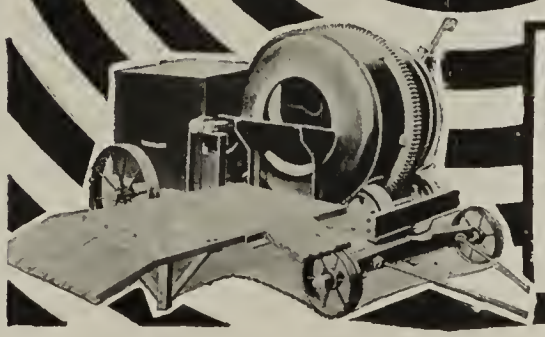
Western Wheeled Scraper Co.
Aurora, Illinois

THE BARGAIN CENTER ON MIXERS

SPEED QUALITY **Packard** HAND AND POWER MIXER

LIGHTEST, STRONGEST, FASTEST small Mixers made. MIX CONCRETE, MORTAR and PLASTER—"High Speed" action, same as $2,000 Pavers. Perfect mix in 15 seconds. Discharge in 10 seconds. Guaranteed full year. Good any time.

POWER CHARGERS
5 Ft. Size, complete as shown, Automatic Power Loader, Measuring Water Tank **$290**
10 Foot Size, Complete **$430**



LOW CHARGERS
5 Ft. size on trucks, 3 H. P. engine, steel housing low barrow hopper **$185**
10 Ft. size on trucks, special 4 H. P. engine steel housing, low barrow hopper **$300**

CONTRACTORS' MACH'Y. CO.
130 Johnson St., Keokuk, Iowa

WHITE WATERPROOFED CEMENT

The Sandusky Cement Company, T. 2 Engineers Bldg., Cleveland, Ohio, has just issued a handsome catalog on "Medusa White Waterproofed Portland Cement."

This white waterproofed cement has been manufactured by this company to overcome the objection which is sometimes raised among architects and engineers that waterproofing material is not properly mixed and proportioned with the cement. They sometimes hesitate to specify waterproofing material of any kind on this account, although realizing its value in the finished product.

To overcome this object Medusa waterproofing is now being ground with Medusa white Portland cement in the process of manufacturing in the proportion of 6 pounds of waterproofing to each barrel of cement. The fact that this mixture and proportioning is done right at the mill by the manufacturers insures its correctness, so that architects and engineers need have no hesitancy in specifying it.

The catalog which is just out tells what this product is, and gives specifications for its use, together with suggestions as to a number of different things for which it can be used; and also gives a large number of illustrations of residences and other structures which have been finished with Medusa waterproofed white Portland cement. Altogether it is a most attractive piece of work and is well worth sending for.

FREIGHT RATES ON CEMENT IN MICHIGAN

Representatives of cement manufacturers from the Alpena and Newaygo, Michigan, districts, with delegations representing the railroads of the state, spent almost a whole day recently before the railroad commission in an attempt to agree on new rates on cement.

The United States Steel Corporation, it is alleged, by reason of ruling of the interstate commerce commission, can secure a lower freight rate from its plants near Chicago and Duluth to points in the upper peninsula of Michigan than Alpena and Newaygo shippers can secure from the state railroad commission. The shippers want the commission to bring the present rates down to a point where they can compete with the steel corporation.

ELECTRIC HAULAGE LOCOMOTIVES

Six Jeffrey 15-ton haulage locomotives are being used at the plant of the Empire Limestone Company, near Buffalo, N. Y., for hauling limestone from the quarry to their crusher plant.

Each locomotive is capable of handling ten to fourteen round trips of seven cars each per day of eight hours—allowing suitable time for loading and unloading of limestone.

The average load of stone per car is ten tons. Each car without load weighs 7,500 pounds. This makes a total of 674 tons hauled by each locomotive per day. The distance between the quarry and crusher plant is one mile, half of which is over 1½ per cent grade. It is often necessary to lay temporary tracks to get the cars near a new working place in the quarry. Though these locomotives weigh 15 tons each, it is possible to operate them over temporary tracks. Each locomotive is equipped with cable reel which permits it to operate beyond the limit of the trolley wire.

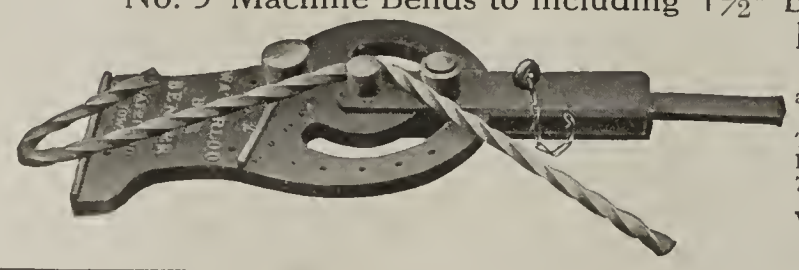
Jeffrey Electric Haulage Locomotive at the Plant of Empire Limestone Co.

The general dimensions of these locomotives are: Gauge, 56½ in.; width, 20½ in. wider than gauge; length over bumpers, 13 ft. 6 in.; height over frame, 45 in.; height over cab, 7 ft. 0 in.; wheel base, 65 in.; diameter of axles, 4½ in.; wheel diameter, 33 in.

Bulletin No. 124-14 issued by the Jeffrey Manufacturing Company, 914 North Fourth street, Columbus, O., fully describes their electric locomotives. Send for a copy.

The Waterloo Bar Bender will pay for itself on the first job

No. 2 Machine Bends to including 1⅛" Bars, weighs 110 lbs. Price - - **$18.00**
No. 3 Machine Bends to including 1½" Bars, weighs 210 lbs. Price - - - **23.00**
Machine Stand weighs 90 lbs. Price - **10.00**



The price of this bender is returned to you in time and money saved on your first job, and the machine itself is indestructible, so you multiply this saving year by year.

Makes bends at various angles to meet any design. Bending posts of turned steel. The post that revolves through the slot in the plate is equipped with loose steel roller to keep bar from creeping during bending. Machine is furnished with detachable haudle 7 ft. long. No. 2 machine is especially adapted for field work.

Waterloo Construction Co., - - Waterloo, Iowa

Fuller Face Hardened Sprocket and Traction Wheels

Unequaled for severe duty. Proven by test. Their use prolongs the life of chain.

RESULTS:—Increased Efficiency—Saving in Operating Cost.

We manufacture all kinds of wearing parts subjected to abrasion.

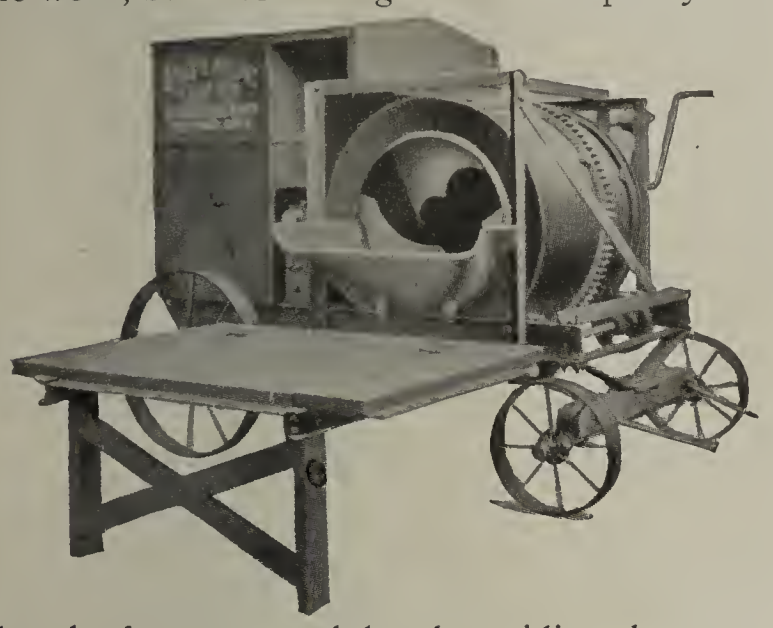
Write for Fuller Quality Products Catalog No. 50—C

Lehigh Car, Wheel & Axle Works, :: Catasauqua, Penn.

REPUBLIC LOW-CHARGING LIGHT TEN MIXER WITH PLATFORM

The cut shown herewith is one of the most popular 10 ft. mixers that has appeared on the market this season.

This mixer really combines the advantages of both large and small mixers, having lighter weight than big machines, making it more easily hauled and placed on the work, but also having sufficient capacity to hold



a full sack of cement, each batch avoiding the necessity of mixing half size batches and splitting a sack of cement.

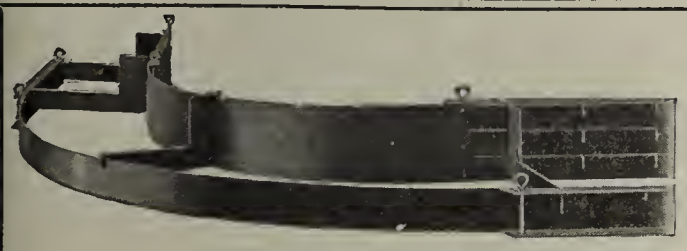
Many new and original labor-saving features are built into these machines, and from the illustration it will be noticed that the mixing drum is one that can be very easily cleaned owing to the large drum opening and the absence of pockets or other cement collecting construction.

An unusual feature about this is the large, roomy engine housing, making it easy to make adjustments, also self-adjusting bearings to avoid binding of the working parts and the platform folds up for moving, making the mixer instantly available when placed on the job.

Many large contractors are ordering these mixers, using them in preference to heavier machines, especially where it would be difficult to place a big machine owing to the condition of the ground, or the inconvenience of moving it in and out, therefore, many of these mixers form a part of every large contractor's outfit, and for medium and small contractors it proves a splendid investment, owing to the few men required to turn out large quantities of mixed concrete or being adaptable for small jobs. Further information may be obtained regarding this machine and other sizes from the Republic Iron Works, Box 454, Tecumseh, Mich., a firm who has been in business for 69 years, and have a reputation for good, high-class machinery at extremely favorable prices.

JEFFREY MFG. CO.'S NORTHWESTERN BRANCH OFFICE AT SEATTLE

The Jeffrey Manufacturing Company of Columbus, Ohio, announce the re-opening of their Northwestern branch office at Seattle, Wash., and the appointment of Mr. Percy E. Wright, consulting mechanical engineer, as district manager for Oregon, Washington, Alaska, British Columbia and Alberta. Mr. Wright, who has been in the Northwest since 1910, and whose connection with this company, dates back to 1902, has had a wide and varied experience and training in the handling of the Jeffrey line in the engineering, construction, and sales departments, which will enable him to be of great asistance to customers in solving their elevating, conveying and transmission problems.

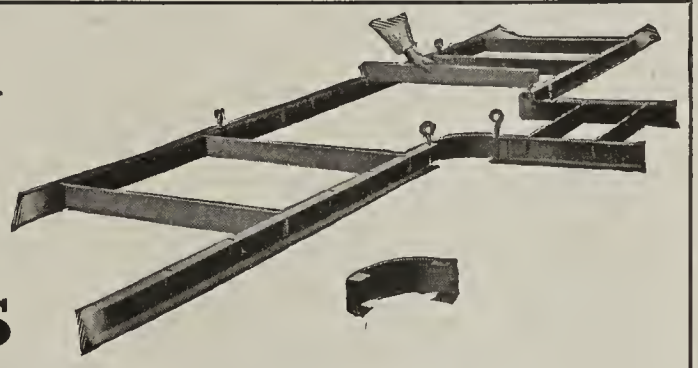


Time Is Money

YOU CAN SAVE BOTH

by using the all steel, adjustable

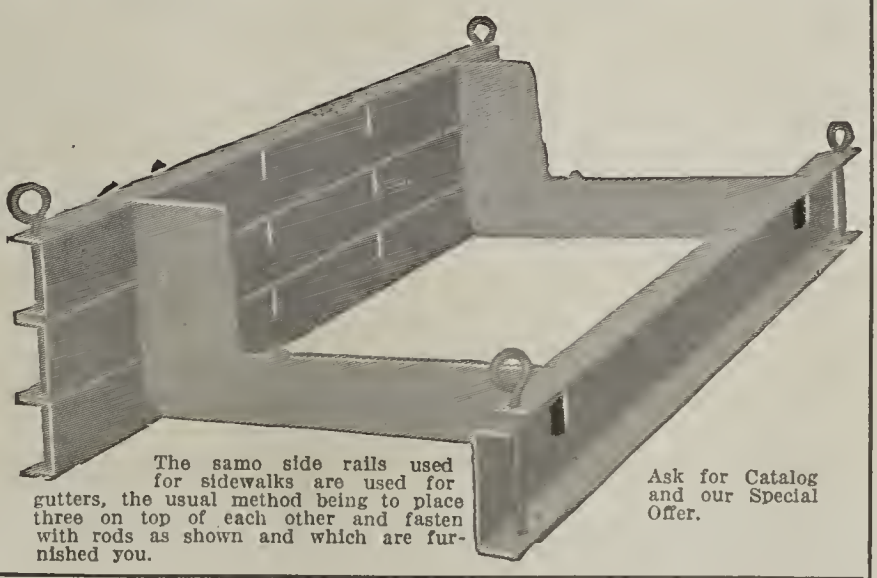
INDIANA FORMS



It's not a question of whether you want to be up-to-date in your methods, it's a matter of dollars and cents.

USE INDIANA SIDEWALK AND CURB AND GUTTER FORMS

The time you waste and the money you waste tinkering with two-by-fours on sidewalk and gutter work means just that much less profit for you on each and every job. It is not whether you can afford to buy steel forms, but whether you can afford to do without them, that you should consider.



The samo side rails used for sidewalks are used for gutters, the usual method being to place three on top of each other and fasten with rods as shown and which are furnished you.

Ask for Catalog and our Special Offer.

THE AUTOMATIC SEALING VAULT CO.

216 East River Street **PERU, IND.**

CONKLIN SERVICE

For the man who is equipped with Conklin molds or the man who is thinking of going into the silo or other circular building business, the Conklin Construction Company are prepared to offer considerable help and service.

The instructions for handling their molds to secure the best results are very carefully worked out and in addition when possible they furnish a man to give personal instruction in the proper method of operating their forms.

To the man who has their equipment there are many possibilities for help in all kinds of work. Silo molds do not have to be used merely for silos but are equally useful for all kinds of circular buildings. The use of them for tanks, coal bunkers, grain bins and many other varieties of construction often presents the possibility of getting the most satisfactory and economical building in the quickest time.

The Conklin Company have many designs showing methods of construction and reinforcing that are needed for many different kinds of buildings. Their expert advise is freely offered for all kinds of work for which their silo molds are available.

This company also have a mold that is adjustable so that it can be used for concrete chimney construction. They also have plans showing the wall thickness and reinforcing for chimneys of various heights.

The details of their various propositions for contractors and builders can be secured by writing to them at 430 West Main Street, Hartford, Mich. Contractors should get these particulars because of the adaptability and economy that can be effected many times by building circular buildings with movable steel forms.

FREE BOOK ON CONCRETE MACHINERY

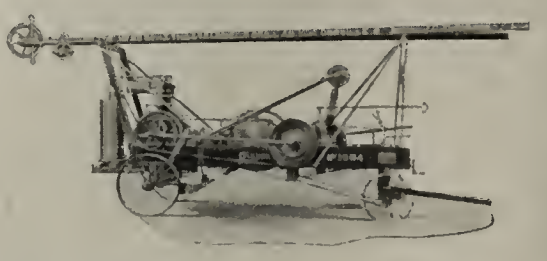
W. E. Dunn Mfg. Company, 414 Twenty-fourth Street, Holland, Mich., is offering to send to builders a copy of its free book on concrete machinery. It is not exactly a catalog because it gives the cost of making a number of concrete products, such as porches, chimneys, fence posts, building blocks, etc., and also tells about the profits in drain tile making for farmers. A copy of the book will be sent free to anyone sufficiently interested to apply to the company.

A Big Blast-Hole Drill That's Reliable

—THE CYCLONE No. 14—

Heavy, solidly braced frame—Sill timbers 4" x 14". All machinery placed directly on the main sills protecting it against strains and preventing top heaviness. **Eighty per cent (80%) of the castings are cast steel**—not cast iron. The Cyclone No. 14 is the only Blast-Hole drill so built.

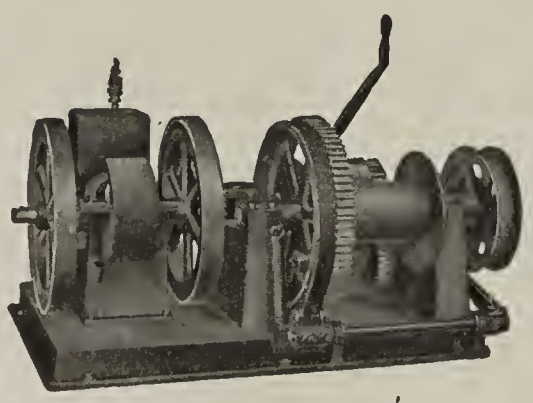
Furnished in Steam, Gasoline, Compressed Air or Electric Power; traction or non-traction.



THE SANDERSON-CYCLONE DRILL CO., ORRVILLE, OHIO

Eastern and Export Office, 50 Church St., New York, N. Y.

BUILDERS' HOISTS and MATERIAL ELEVATORS



Hoist and Engine complete, direct connected, three sizes, 5, 6 and 8 H-P.

Every up-to-date builder and contractor should post himself on the most economical way to elevate building material. We have prepared an interesting booklet on

HOISTS and ELEVATORS

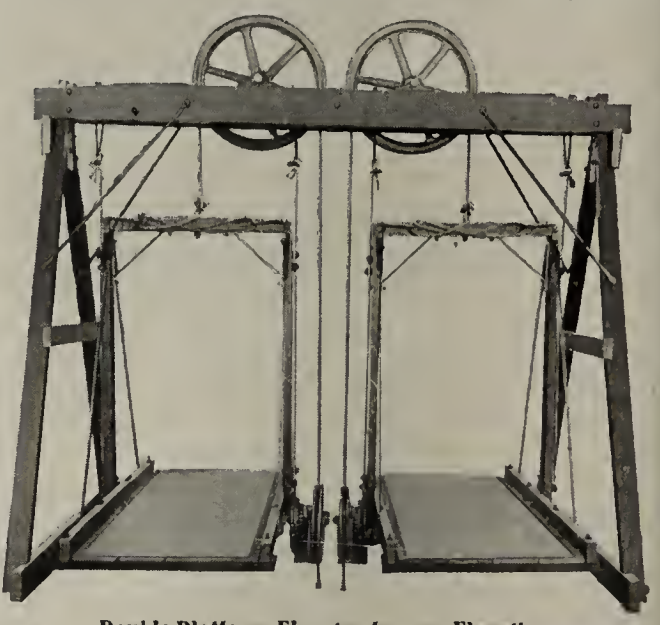
which we will send to anyone interested.

Write for it.

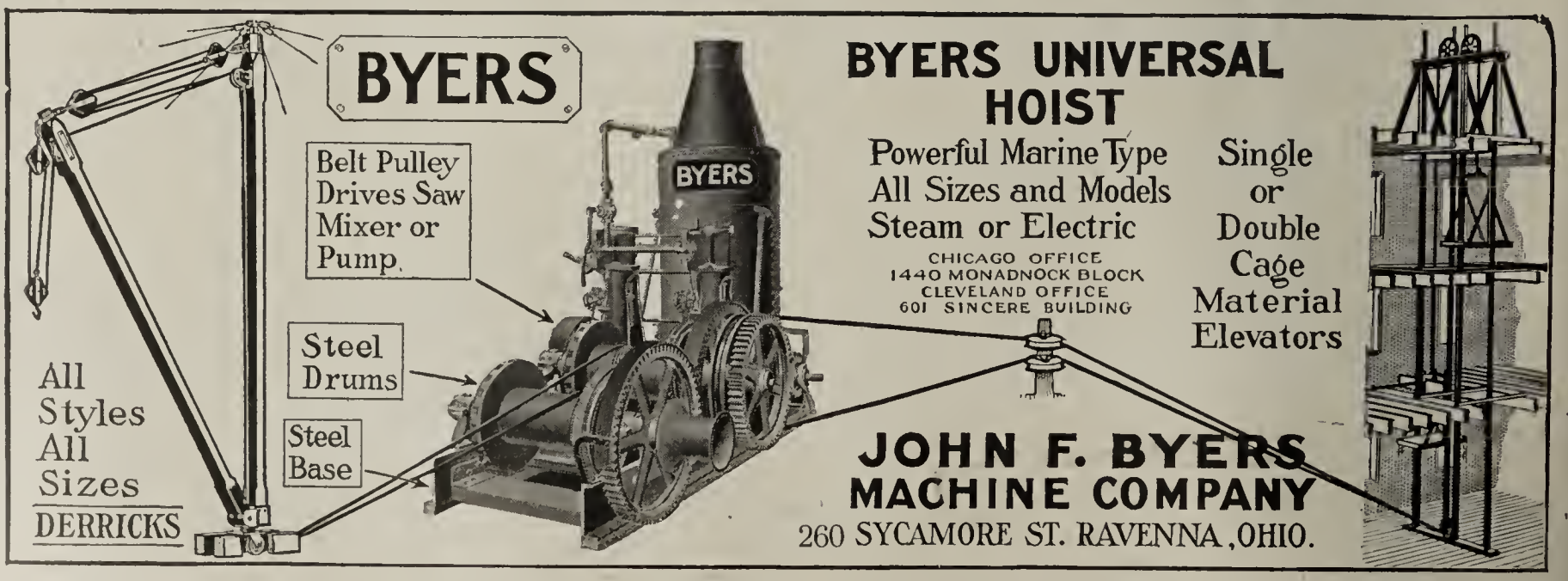
Bates & Edmonds Motor Co.

114 Hill Street

Lansing, Mich., U. S. A.



Double Platform Elevator for any Elevation



MONARCH CEMENT COMPANY'S IMPROVEMENTS

T. J. Klossoski, cement mill engineer, is now in Humboldt, Kansas, remodeling the Monarch Cement Company's plant, putting in complete coal installation, clinker handling equipment, which consists of special economizing chambers through which the clinker is chuted; a 140 ft. Peck carrier furnished by the Link Belt Company, Chicago & Philadelphia, with cold water bath and spray, entirely new raw and clinker grinding departments including big Williams Jumbo hammer mills, a No. 3 and a No. 6 Universal Grinders for tube mill feed, furnished by the Williams Patented Crusher & Pulverizer Company, Chicago and St. Louis, and largest size tube mills, 7x24 ft. (cylpeb compartment) both Silex and Manganoid lining, furnished by Worthington Pump & Machinery Corporation (successor to Power & Mining Machinery Co.), New York and Cudahy, Wis.; new sacking machinery furnished by the Modern Bag Company, East Orange, N. J.; a 24-in. Jeffrey Single Roll Pulverizer for coal grinding; Bonnot pulverizers; a 7x70 ft. dryer, weighing machinery and other improvements. This work is now practically completed and enables the plant to run on coal, oil or gas, whichever proves most economical at the time.

ARE ASSISTING DEALERS

In order to assist dealers in making the merits of Medusa products known to the trade, the Sandusky Cement Company, Engineers Building, Cleveland, Ohio, are sending out a circular which is being distributed among dealers. This circular shows in detail how the company is systematically helping the dealers who sell their well known products.

FREIGHT RATES ON SAND

John F. Lent, president of the Traffic Club of Pittsburgh, as counsel for the Ohio Sand Traffic Association, which is composed of producers and shippers of sand of Youngstown, Zanesville, Columbus, Conneaut, New Lexington and Cleveland, Ohio, has filed with the Public Utilities Commission of Ohio a complaint against the Pennsylvania Lines West, the Baltimore & Ohio, the Erie and the Wheeling & Lake Erie railroads, alleging that these roads are charging for transportation of sand in carload lots unreasonable and unjust rates. He asks that the offending roads be required to publish and maintain for the shipment of sand specified rates that will be just and equitable and that an order be made supplying maximum rate for the service.

CONCRETE ROADWAY

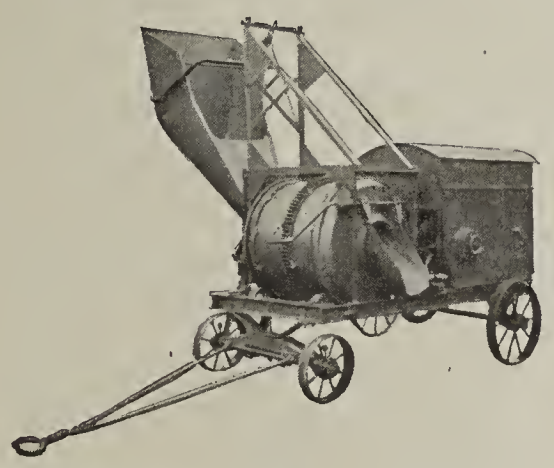
The Wilbur Lumber Co., Milwaukee, Wis., was awarded a contract for $34,843 worth of cement by the board of supervisors of Milwaukee county last week. This is the cost of 17,300 barrels of cement to be used on thirty-two miles of concrete roadway to be constructed in that county this year. At the close of the season Milwaukee county will have 135 miles of paved roadway.

LIME GOES HIGHER

The Ohio & Western Lime Company, Huntington, Ind., has announced an advance on lime of from $1 to $2 a ton. The increase is due, according to the company, by reason of advance of sacks, dynamite and other commodities. The advance on sacks alone is $35 per thousand, dynamite 75 per cent, and other articles in proportion.

LANSING FIVE

—Rotary Pump
—Side Loader
—Ideal or Novo Engine
—Gear Driven
—Folding Platform



—Silo Hoist
—Batch Hopper
—Water Tank
—High Wheels
—Wagon Tread

THIS MIXER MUST EXCEL

It has been a positive necessity for us to make the Lansing Five the best mixer in the world at anywhere near its price. We went into the business of making mixers knowing that the field already was well filled, that many concerns were making good mixers and selling them at reasonable prices. But, backed by a great thirty-five year old concern with a paid-up capital of $1,500,000 and a world-wide reputation, we entered the field with a reputation and standard to uphold, not with a reputation and standard to create. So, obviously, we had to build a mixer which would stand head and shoulders above everything else in its class. We were forced to make the Lansing Five excel —AND IT DOES.

LANSING COMPANY
"KEEP YOUR PRODUCT ON WHEELS"

Write for Catalog 354-M
LANSING :: MICHIGAN

WAREHOUSES:
CHICAGO, 169 W. Lake Street MINNEAPOLIS, 517-519 N. Third Street
NEW YORK, 288-289 West St. PHILADELPHIA, N. American & Willow
KANSAS CITY, 1413-1415 W. 10th St. SAN FRANCISCO, 338 Brannan St.
BOSTON, 78 Cambridge Street, Charlestown Dist.

STREICH
DUMP WAGONS

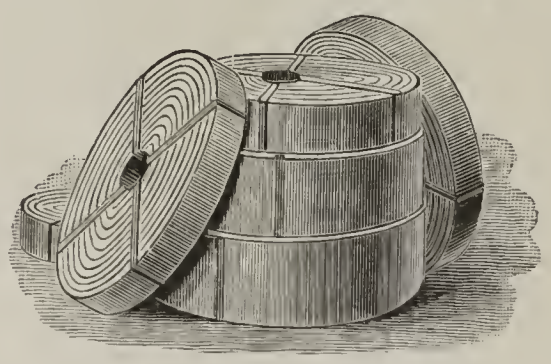
¶ About 90% of the Dump Wagons purchased in the City of Chicago are Streich's. There is a reason. Our wagons run easily because the axles are properly set, and wear long because they are made of the right kind of stuff.

¶ This wagon will dump anything from cinders to the stickiest kind of clay. Weight of contents of load when dumped automatically forces the bottom doors up the sides of body, allowing bottom doors to clear pile. You never see a Streich wagon stalled and you never see a driver shovel in order to get free after a dump.

¶ We build One and Two Horse Wagons from one yard to four yards capacity.

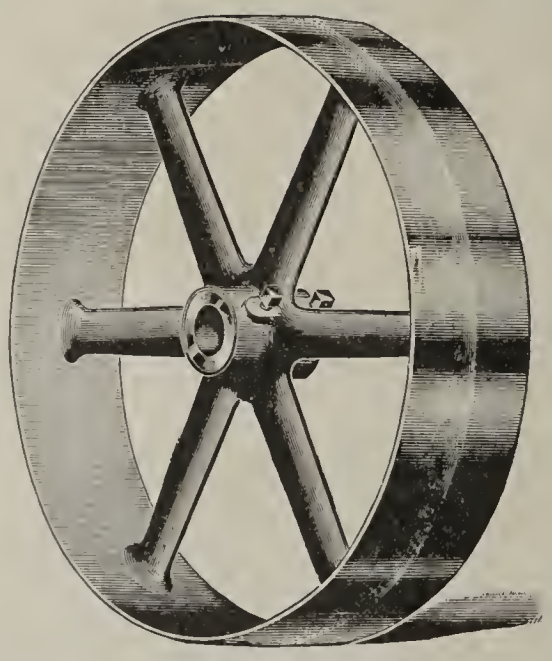
¶ Write for catalog showing complete line of Dump Wagons, Garbage and Asphalt Wagons.

GET OUR NET PRICE CATALOG No. C-71
OF SUPPLIES
AND SAVE MONEY AND TIME ON YOUR PURCHASE OF REQUIREMENTS

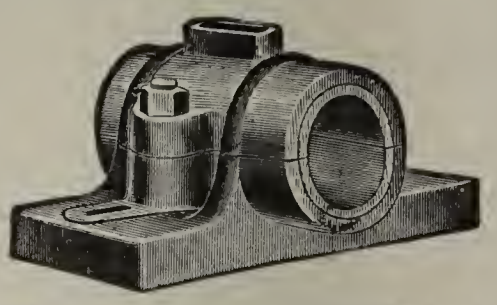


Belting—Leather, Rubber, Balata, Canvas and Cotton

Elevator Buckets —Continuous Steel, Malleable Iron, Etc. Salem Steel and Grain Buckets

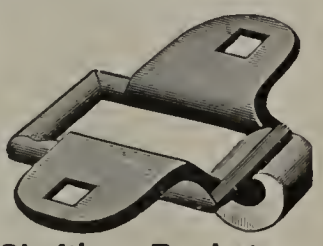


Pulleys—All Kinds



Bearings—Rigid and Adjustable

Chain Belting and All Sizes of Attachment Links

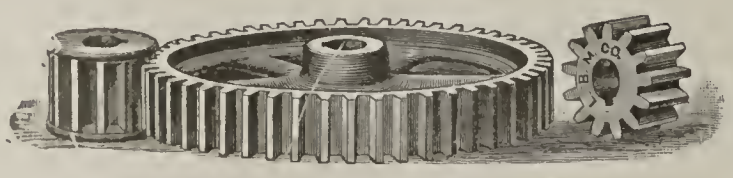


Take-up Boxes, Shafting, Buckets, Bolts, Hose, Conveyor, Etc.

ESTABLISHED IN 1872

B. F. GUMP CO.

INCORPORATED IN 1901



431-437 So. Clinton St.

CHICAGO

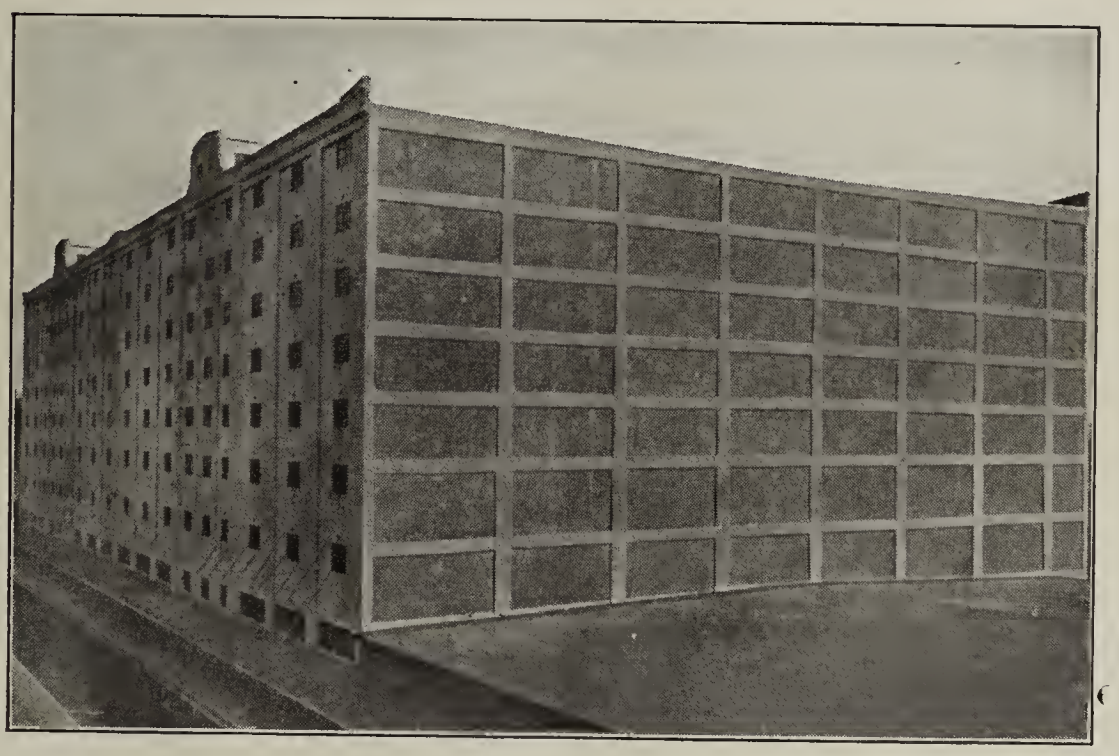
Send a Postal Request for Catalog To-day

New Reinforced Concrete Plant of the Naumkeag Steam Cotton Company

A new reinforced concrete plant, representing the most advanced standards in mill construction, and attracting wide attention, has been completed for the Naumkeag Steam Cotton Company at Salem, Mass. This new plant takes the place of a number of buildings, which were entirely destroyed by the Salem conflagration in June, 1914.

There are three principal structures included in the new plant, the storehouse, the spinning mill and the weave shed. The buildings are designed for their particular uses in the process of manufacturing cotton cloth, but they are at the same time of very pleasing architectural appearance.

The storehouse is a building of five stories and a basement, 500 feet long, 108 feet wide at one end and 57 feet wide at the other. The mushroom type of construction is used in this building, and there are steel sash throughout, and in addition to storage space, this building contains sampling and opening rooms.



The spinning mill, of beam and slab construction, 722 feet long and 135 feet wide, consists of four stories and the basement. The column spacing is 26x24 feet. On account of the wide spacing of the columns and the loads that the several floors would have to carry, it was found advisable to change from the regular type of reinforced column to columns with structural steel cores in those that support the 2d, 3d and 4th floors. By doing this, the diameter of the columns was kept to a minimum, thus saving valuable floor space in the mill.

The floors of the picking and carding departments are finished with a granolithic top, while other departments in this building have a wood top floor. In the floors with wood top the regular concrete slab is poured, on this are laid screeds held down to the concrete by clips which have been imbedded in the concrete, and the space between the screeds filled with cinder concrete. On top of these screeds is laid an intermediate floor; both screeds and intermediate flooring being treated with wood preservative, and the whole finished with a maple top floor.

The roof pitch is obtained by filling in with cinder concrete at the proper depth on top of the roof slab so that the water will drain to the several conductor pipes which pass down through the inside of the building. On top of the cinder concrete is a tar and gravel roof. Steel sash are employed throughout and double glazing on the north and east sides.

The weave shed is 990 feet long, one portion of it being 420x482 feet and the other 508x212 feet. The roof of the weave shed is made of beam and slab construction and in order to do away with condensation, a layer of cork was placed directly on the slab and on top of this the asphalt and slag roofing is placed.

The skylights are made up of hollow metal sash of double glazing so as to insure against condensation. The ventilators placed at different parts of the roof at the high point of the sawtooth skylights are controlled from dampers from the inside. The floors are finished with a wood top made up in a similar manner to those in the mill. The cloth room is contained in this building.

These buildings were designed by Lockwood, Greene & Co., engineers, of Boston, Mass., and erected under their supervision.

METHODS OF REPAIRING AND PATCHING CONCRETE

The following data on the various methods used in repairing and patching concrete structures were collected by the Committee on Masonry of the American Railway Engineering Association:

Wet Method

The surface of the old concrete is thoroughly roughened, cleaned, and drenched with water, and covered with a cement grout. Then the new concrete is mixed to a sloppy consistency and applied, being held in place till set by forms, as required.

From the reports received, it appears that many successes and many failures have followed this method. Where it has been successful, that result probably has been due to painstaking care and expense being employed in the preliminary cleaning and thorough wetting of the old concrete surfaces before the new concrete is applied.

Moderately Dry Method

The surface of the old concrete is thoroughly roughened, cleaned, and drenched with water, and powdered with cement or painted with cement grout, after which the new concrete is applied and thoroughly tamped against the old surface. Generally, such patches are kept moist by sprinkling them with water for several days.

The same comment applies here as to the wet method.

Dowel Method

This is a modification of the two preceding methods, and is generally used for other than horizontal surfaces, although it may be applied to the latter. The new concrete may have any consistency to meet the particular conditions or the ideas of the engineer in charge; but usually a fairly wet concrete is used. This method includes drilling holes and setting dowels into the old concrete, with projecting ends to engage into the new concrete. Sometimes steel bars or metal fabric are connected to these dowels to further ensure permanency of the pitch.

This method can be made uniformly successful, but cannot always be applied. Where any considerable mass of new concrete is to be connected to old concrete, this is the only safe method to pursue.

Wedge Method

This method includes the cutting out of defective concrete in such a manner as to under-cut the surrounding good concrete so that the new concrete will be held in place, when set, by the shape of the binding edges of the old concrete.

The difficulty of under-cutting concrete so as to secure such edges is too great to make this method applicable in ordinary cases; and, except where a considerable depth of new concrete is to be put in, such under-cutting could not be successfully done, as concrete cannot be cut so as to leave sharp, clean edges.

Cleaning with Steam

This is a method of cleaning surfaces of old concrete, preparatory to putting on a patch of new, or of cleaning the top of a rough concrete floor before applying the "finish coat." The surface of the old concrete is brushed as clean as possible with stiff brushes, and then gone over at least twice with a steam jet. An ordinary piece of ½-inch gas pipe makes a very satisfactory jet nozzle. This short length of pipe is connected to a steam hose so that it can be readily moved about. The steam is supplied by the boilers of the mixer or hoisting engines. The steam will clean and heat the concrete surface, leaving it perfectly dry; so it is important to drench the surface thoroughly with water after cleaning with steam. In cold weather it is found advantageous to use hot water. Immediately after the surface is thoroughly cleaned and drenched, the new concrete is applied.

Excellent results have followed the use of this method of cleaning; but it is essential that the surface of the old concrete be thoroughly drenched with water after using the steam jet, otherwise the new concrete will not adhere to the old.

Cleaning with Acid

This method includes washing of the surface of the old concrete with a solution of hydrochloric (muriatic) acid (one part acid to two parts water), after which the surface must be carefully and thoroughly washed to remove any free acid.

This is a very commonly applied method of cleaning old concrete surfaces preparatory to placing new concrete against them, and, by many, is considered the only safe treatment to use, especially in cases where a "finish coat" is to be put on after the concrete base is set.

PROPERTIES OF CONCRETE

The Bureau of Standards, Department of Commerce, Washington, D. C., has just issued Technologic Paper No. 58, dealing with the properties of concrete and Portland cement mortars, under the title "Strength and Other Properties of Concretes as Affected by Materials and Methods of Preparation." It includes the results of about 20,000 tests on about 300 aggregates consisting of limestone, granite, gravel, and trap rock which are used for concrete materials in various sections of the United States. Copies of the publication may be obtained free upon request.

The results are of especial interest to contractors, engineers, architects, and others who use concrete, since it points out that with the same aggregates a variation in strength of as much as 100 per cent may result, owing to the lack of proper precautions in mixing and placing the material. The effect on the compressive strength of each of the factors, such as type of aggregate, method of mixing, method of molding, the consistency, the density, the method of storing or curing conditions, abnormal methods of curing, characteristics of the aggregate, proportions of cement to aggregate, age, etc., are studied separately and the results are shown of storing or curing conditions, abnormal methods in tables and diagrams. One of the most important conclusions to be derived from the results is that the use of too great an amount of mixing water, which is common in present day construction, accounts for many concrete failures. The use of an excessive amount of mixing water may result in a reduction in strength as great as would result from a reduction of 50% in the amount of cement used. The results indicate that proper methods of mixing and fabrication are as important as good cement and aggregate in producing a concrete of the best quality.

CEMENT MAKERS TO MEET

Representatives of over 100 Portland cement manufacturing concerns of the United States will hold their national convention in Detroit September 11, 12 and 13. The executive committee of the Cement Manufacturers' Association stated that it has been the custom of the association to hold its annual fall gathering in Atlantic City, but, owing to the prominence the roads of Wayne county have attained throughout the country, the manufacturers feel it necessary that they should fully acquaint themselves with the success attained in the use of cement in road building, as exemplified in the roads of this county.

Gravel Aggregate for Concrete

Can We Use a More Fine Aggregate? Tests Made by Prof. W. K. Hatt, Director of Laboratory for Testing Materials, Perdue University, Lafayette, Ind.

The dividing line between coarse and fine aggregate for concrete is ordinarily taken as the ¼-inch screen. All material which passes this screen is sand, while everything retained upon it is coarse aggregate. This division is generally supposed to have been dictated by good practice; but the economic result has been that most deposits have thus produced an excess of material which must be classed as sand, and which could not readily be marketed at advantageous prices, so that the loss on this has been spread over the whole output, adding a considerable item to the cost of concrete.

RESIDENCE OF JOHN J. NOLAN, WEST MEDFORD, MASS.
Architect, John J. Smith, Boston, Mass.

Stucco houses are today one of the most popular styles of dwellings, and there are an increasing number of them being built every year. Considered from the viewpoint of the owner, they have many economical advantages which is no doubt the reason for the constantly increasing demand for this type of house by the prospective house-owner. They have passed the experimental stage and have become one of the standards.

In other words, if the entire output of a normal deposit could be used for concrete, it was recognized that it could be marketed more advantageously and at the same time reduce the cost to the consumer.

Following up this idea, the Indiana Sand and Gravel Producers' Association, Majestic Building, Indianapolis, asked Prof. W. K. Hatt of Purdue University, Lafayette, Ind., to conduct a series of tests to determine whether the disadvantage of a larger percentage of fine material was as great as popularly supposed. The most that it was hoped to show was that the decrease in strength would be only slight and would be allowable on many classes of work in view of the lower cost; but the actual results were surprising in that the mixtures with the fine material showed uniformly greater strength than those with the standard division at ¼-inch.

While this is but one series of tests, on material from one source, so carefully were they carried out and so conclusive do they appear, that some engineers, especially on highway work, have signified their willingness to accept them and with their specifications accordingly. The following is an outline of the tests as prepared by Prof. Hatt:

(1) **Preliminary Tests.**

(a) Determination of Specific gravity. Two determinations were made for each sample by the method of introducing a given weight of aggregate into a graduate containing a given volume of water.

(b) Sieve Analysis of Aggregate. Two determinations were made for each sample. The dry aggregates were separated into their constituent sizes by means of a set of Tyler standard screen scales. The percentage by weight passing the various size screens was determined.

(c) The effect of the contained moisture on the weight per cubic foot and per cent voids of the fine aggregates. This determination consisted in obtaining the weight of a given volume of fine aggregate with different amounts of contained moisture. To approximate conditions of practice, the material was shoveled from the floor into the measuring vessel as in service.

(2) **Relative Value of Fine Aggregates,** as shown by strength of 1 to 3 mortar.

Two-inch cubes for compression tests were made, using 1 part by weight of a mixture of Alpha, Atlas, Lehigh and Universal cements to 3 parts of dry fine aggregate. Two-inch cubes were also made up, using the same materials, but the proportions were by loose volumes as in service with an average moisture cement. The test pieces were tested in compression at end of 7, 28, 47 and 52 days.

(3) **Relative Strength of Concrete** of ⅛-inch separated material and of ¼-inch separated material for an arbitrary 1:2:4 proportion, measurement being on basis of moist volumes fairly loose. In this there were two series, I and II. Two series of compression test cylinders were made, using Lehigh cement and the aggregates with an average moisture content. For accurate proportioning by volume, it was thought necessary to determine the weight per cubic foot with the moisture present, and then fractions of cubic feet by weight. This weight was determined in each case by shoveling the moist aggregate into a cubic foot measure, thus approximating commercial practice of measurement.

In each of Series I and II a set of three test pieces was made, using each size of aggregate. The conditions of manufacture were exactly the same in the case of each kind of aggregate. The various steps involved were as follows:

(a) Aggregates were brought to the same conditions as to moisture. This was judged by the eye.

(b) The weight per cubic foot was determined under approximately the conditions of commercial measurement, i. e., deposited in a measuring box by hand with a shovel.

(c) Determination of the per cent moisture present at time of measuring.

(d) The required weight of aggregate and cement were then placed in a Chicago cube mixer and mixed for one minute. The water was then added and mixing continued for three minutes longer. All batches were mixed to the same medium wet consistency.

(e) Three 8-inch diameter by 16-inch height cylinders were molded from each batch with slight puddling and sides spaded by means of a trowel.

(f) The forms were removed from all test specimens after 1½ days. The specimens were stored under moist sand until four days before a test. They were then removed and capped with plaster of Paris to give smooth ends.

(g) Specimens were all tested at age of 28 days.

Series III and IV were made with the same methods as above, but the proportions for the mixture using material divided on the ⅛-inch screen, were varied in the attempt to produce a stronger concrete. The new proportions used were such as to make the sieve analysis curve of the mixture of cement plus aggregate, approach more closely to that of the 1:2:4 mix of the ¼-inch divided aggregate.

Series V. These specimens were made up, using an entirely different aggregate and cement. An aggregate from Lafayette banks was screened on a ¾-inch screen. The material passing the ¾-inch screen was divided and recombined according to the requirements of Fuller & Thompson's maximum density curve for cement plus aggregates.

One set of test specimens was made up, using the material divided on the No. 8 screen, and another set, using material divided on the ¼-inch screen.

The actual proportions used in Series V were as follows:

Material divided on No. 8 screen, 1:1.1:3.9 by dry weight.

Material divided on ¼-inch screen, 1:2.04:2.96 by dry weight.

Results of Tests

A summary of the averages of the different determinations may be found in the following tables:

Table 1. Specific Gravity. Two determinations for each material.

⅛-inch sand	Specific gravity 2.65
¼-inch sand	Specific gravity 2.645
⅛-inch-1¼-inch gravel	Specific gravity 2.655
¼-inch-1¼-inch gravel	Specific gravity 2.655

Table 2. Effect of Moisture on the Weight per cubic foot and per cent of Voids of the Fine Aggregates.

Moisture (per cent.)	Weight (lb. per cu. ft.)	Voids (per cent.)
¼-inch Sand—		
0 (air dry)	111.8	32.4
0.5	109.0	34.2
1.28	99.9	40.2
1.96	98.7	42.25
3.31	99.9	41.3
4.01	101.8	40.7
⅛-inch Sand—		
0 (air dry)	105.2	36.5
1.64	99.4	40.3
1.64	93.7	43.9
2.36	92.8	44.8
3.18	93.4	45.0
4.94	95.3	45.0

Note—Percentage is on basis of dry weight. Material was deposited in 1 cubic foot measure by shovel.

Table 3. Voids in the Coarse Aggregate. Three determinations for each material.

Gravel	Moisture	Weight (lb. per cu. ft.)	Voids (per cent.)
⅛-inch to 1¼-inch	Air dry	105.8	34.1
¼-inch to 1¼-inch	Air dry	100.7	38.75

Table 4. Sieve Analysis of Aggregates. Three determinations for each material.

Sieves No.	Size in.	Sands ⅛-in.-0-in.	Sands ¼-in.-0-in.	Gravels 1⅛-in.-1¼-in.	Gravels ¼-in.-1¼-in.
1¼	1.25	...	...	100	100
1	1.00	...	...	99.5	98.75
¾	.75	...	...	96.3	92.4
½	.50	...	100.0	87.0	78.6
¼	.25	100.0	98.7	52.5	17.5
4	.185	99.5	90.5	...	...
6	.131	97.4	78.0	...	...
8	.093	91.2	67.3	9.1	0.1
10	.065	81.0	57.0	...	...
14	.046	69.6	47.7	...	...
16	.042	...	...	...	...
20	.0328	58.6	39.5	2.1	00
28	.0282	42.5	27.4	...	...
35	.0164	23.1	14.2	...	...
48	.0116	11.0	6.3	...	...
65	.0082	5.0	2.5	...	...
100	.0058	1.8	0.8	...	...
200	.0029	0.8	0.3	...	...

Table 5. Relative Strength of 1 to 3 Mortar Made with each of the Fine Aggregates. Compressive strength (lb. per square inch).

	1 to 3 by weight ¼-in. sand	1 to 3 by weight ⅛-in. sand	1 to 3 by moist loose vol. ⅛-in. sand	1 to 3 by moist loose vol. ⅛-in. sand
7 days	1603	2165	2173	2575
28 days	2798	3730	3455	3843
52 days	3201	4043	*3718	*4138

Each value is average of three tests. *47 days.

Table 6. Relative Strength of Concrete in Arbitrary 1:2:4 Proportions, Measurement Being by Moist Volumes. Each value is the average of three tests.

	Aggregates divided on ⅛-in. sieve	Aggregates divided on ¼-in. sieve
Series I—Av. compressive strength at 28 days (lb. per sq. in.)	3110	2890
Series II—Av. compressive strength at 28 days (lb. per sq. in.)	3610	3450
	Proportion (moist vol.) 1:0.555:5.22 Aggregates divided on ⅛-in. sieve	Proportion (moist vol.) 1.2.4 Aggregates divided on ¼-in. sieve
Series III—Av. compressive strength at 28 days (lb. per sq. in.)	2540	2118

Different batch of cement from Series I and II.

	Proportion (moist vol.) 1,2,4 Aggregates divided in ¼-in. sieve	Proportion (moist vol.) 1:0,534:5,22 Aggregates divided on ⅛-in. sieve
Series IV—Av. compressive strength at 28 days (lb. per sq. in.)	3620	4090

Proportions 1 to 5 by dry weights.

Material: Lafayette bank gravel passing ¾-inch sieve. Cement was mixture of Atlas, Alpha, Lehigh, Universal.

	Aggregates divided on ¼-in. sieve	Aggregates divided on ⅛-in. sieve
Series V—Av. compressive strength at 28 days (lb. per sq. in.)	2655	2375

Discussion of Results

1. The average specific gravity of 2.65, as given in Table 1, shows the material to be of average grade as to weight and quality.

2. Table 2 illustrates the variation of each fine aggregate as to weight and voids when the contained moisture varies from 0 to 5 per cent, of the dry weight. It is seen that as the per cent of moisture in each of the sands increases the unit weight decreases and the voids increase. An average moisture content of these sands may be taken as from 2 per cent to 5 per cent.

On account of the change in weight and volume of these sands with a change in amount of moisture, it is necessary, for accurate work, to assume an average moisture content and then determine an average unit weight and thereafter to determine by weight amounts of material for any given proportion.

The voids are greater and the weight per cubic foot less for all moisture contents in the fine aggregate screened through the ⅛-inch screen than in the fine aggregate screened through the ¼-inch screen.

3. In Table 3 may be seen the voids and weight per cubic foot of the coarse aggregates. The weight is greater and the voids less in the material graded from ⅛-inch to 1¼-inch than in the material from ¼-inch to 1¼-inch.

4. The average grading of the materials as to size is shown in Table 4. By inspection of the data, it will be seen that the amount of material between ⅛-inch and ¼-inch in the various aggregates is as follows:

Aggregate	Per cent, by dry weight, of contained material between ⅛-in. and ¼-in. screen
⅛-in.-0-in.	4 per cent.
⅛-in.-1¼-in.	38.5 per cent.
¼-in.-0-in.	24 per cent.
¼-in.-1¼-in.	14 per cent.

5. The relative value of the fine aggregates as a mortar producing material is shown in Table 5.

One to three mortar from ¼-inch-O sand is stronger than 1 to 3 mortar from ⅛-inch-O sand. This is probably due to its better grading. The difference in strength is less when the proportion of cement to aggregate is taken on a basis of moist loose volume as measured in practice, rather than by dry weight.

6. The strength of the concrete for a 1:2:4 proportion by volume is greater when the line of division between the fine and coarse aggregate is the ⅛-inch screen, than when line of division is the ¼-inch. This is shown by the averages from Series I and II.

In Series III and IV, Table 6, in which the amount of ⅛-inch-0 sand is reduced, the difference in strength is not so clearly defined. In Series III the aggregate divided on the ⅛-inch screen has greatest strength, while in Series IV, using a little less of ⅛-inch-0 sand, the aggregate divided on the ¼-inch screen has the greatest strength. In Series III and IV the comparison in strength is made between the adopted standard 1:2:4 mix of aggregate divided on the ¼-inch and a new proportion for the aggregates divided on the ⅛-inch screen, as explained in Method of Tests.

Series V indicates that for an aggregate whose maximum size of particle is ¾-inch such a proportion may be selected using materials divided on the ⅛-inch screen that the strength of the resulting concrete will be equal to, if not greater, than when the aggregates are divided on the ¼-inch screen.

No comparisons may be made between series because different batches of cement were used in making up the different series.

BIG SAVING BY CONCRETE ROADS.

Cost of Maintenance Is Very Small.

Because Milwaukee county has built concrete instead of macadam county highways it has saved $80,000, which otherwise would have been spent on maintenance. This sum is now available for new road construction, Supervisor Jacobus pointed out Wednesday when he announced that the highway committee would use nearly $50,000 of that fund for new roads in 1916. The $80,000 is the county's share of the automobile license receipts. Counties receive three-fourths of the net profits and the state highway the remaining one-fourth. Milwaukee county received about $50,000 from this source in 1915 and expects over $60,000 in 1916.

"As an example of Milwaukee's saving it is interesting to note that Pennsylvania has just appropriated $6,00,0000 for roads nearly all of which will be spent for maintenance, while New York has appropriated $4,000,000 for the same purpose," declared H. J. Kuelling, county highway commissioner.

"State Highway Commissioner Cunningham, Pennsylvania, who visited Milwaukee roads last fall, told me that the cost of maintenance for roads in Pennsylvania was 60 cents per square yard," said Chairman Jacobus. "The Kansas City delegation told us the same. Our maintenance cost is $25 per mile, or one-fourth of a cent per square yard. Milwaukee county spent $7,000 for maintenance last year out of expenditures of over $750,000, or only 1 per cent."—[Milwaukee Journal, March 9.]

The Hayden-Corbett Chain Company, Columbus, Ohio, report business in steam shovel chain very active. During the last ten days they received orders for a car load of Old Reliable XX Dredge Quality hoisting chain, from three different customers. In one day they received orders for 22 steam shovel hoisting chains. They are suggesting to all their customers, to anticipate their wants as much as possible in order to avoid disappointment in regard to delivery.

ISSUE PAMPHLET ON USE OF HYDRATED LIME FOR CONCRETE ROADS

A discussion of the use of hydrated lime in concrete roads has been issued in pamphlet form by the National Lime Manufacturers' Association of Pittsburgh. No claim is made that the use of the material will prevent or overcome defects in concrete roads built under unfavorable conditions. It is stated, however, that the addition of hydrated lime will, to a great extent, overcome such defects as cracking and soft spots, and will generally improve the durability and wearing qualities of any properly constructed concrete road.

Statements of men of authority in the roads field, who have used hydrated lime, are included in the pamphlet.

CEMENT AND ENGINEERING NEWS

(PUBLISHED MONTHLY)

WILLIAM SEAFERT, Editor and Publisher

Office—672 Transportation Building, Chicago

Telephone, Harrison 5397 Cable Address, "Seaferts" Chicago

Entered at the Post Office at Chicago, as second-class matter, July 21, 1896 under Act of March 3, 1879

SUBSCRIPTION RATES:

United States, Canada, Philippine Islands and Mexico, two years for $1.00; all other countries, $1.00 per year.

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CHICAGO, AUGUST, 1916

PORTLAND CEMENT SPECIFICATIONS

A new specification for Portland cement was adopted at the annual meeting of the American Society for Testing Materials, recently held in Atlantic City, N. J., with the prospect of similar adoption by the letter ballot of the Society, the U. S. Government departmental cement committee, the American Society of Civil Engineers, and many minor societies. This specification, then, will probably be as nearly as possible a nationally accepted standard. Below is given that part of the specifications relating to requirements; there are in addition 33 sections relating to the methods of testing. The new specification is entirely rewritten and rearranged and does not include the requirements for natural cement. The main differences between it and the old A. S. T. M. standard specifications are as follows:

Fineness has been increased from 75% to 78% through a 200-mesh screen, with no prescription for the 100-mesh screen in the new specification. The permissible SO_3 content has been increased from 1.75% to 2% and the MgO content from 4% to 5%. The time of initial set has been increased from 30 minutes to 45 minutes as read on the Vicat needle, and an alternate permission to use the Gillmore needle has been included. The neat test for tensile strength has been omitted and the 28-day tensile requirement for 1:3 mortar briquettes has been increased from 275 pounds per square inch to 300 pounds per square inch. The normal air and cold-water tests for soundness have been eliminated and only the steam test retained.

The first 15 clauses of the specifications follow:

1. Portland cement is the product obtained by finely pulverizing clinker produced by calcining to incipient fusion an intimate and properly proportioned mixture of argillaceous and calcareous materials, with no additions subsequent to calcination excepting water and calcined or uncalcined gypsum.

I. Chemical Properties

2. The following limits shall not be exceeded:

Loss on ignition, per cent	4.00
Insoluble residue, per cent	0.85
Sulphuric anhydride (SO_3), per cent	2.00
Magnesia (MgO), per cent	5.00

II. Physical Properties and Tests

3. The specific gravity of cement shall be not less than 3.10 (3.07 for white portland). Should the test of cement as received fall below this requirement, a second test may be made upon an ignited sample. The specific gravity test will not be made unless specifically ordered.

4. The residue on a standard No. 200 sieve shall not exceed 22% by weight.

5. A pat of neat cement shall remain firm and hard, and show no signs of distortion, cracking, checking or disintegration in the steam test for soundness.

6. The cement shall not develop initial set in less than 45 minutes when the Vicat needle is used or 60 minutes when the Gillmore needle is used. Final set shall be attained within 10 hours.

7. The average tensile strength in pounds per square inch of not less than three standard mortar briquettes (see Par. 57), composed of one part cement to three parts standard sand, by weight, shall be equal to or higher than the following:

Age at Test, Days	Storage of Test Pieces	Tensile Strength, Lb. per Sq. In.
7	1 day in moist air, 6 days in water	200
28	1 day in moist air, 27 days in water	300

8. The tensile average strength of standard mortar at the age of 28 days shall be higher than the strength at 7 days.

III. Packages, Marking and Storage

9. The cement shall be delivered in suitable bags or barrels with the brand and name of the manufacturer plainly marked thereon, unless shipped in bulk. A bag shall contain 94 pounds net. A barrel shall contain 376 pounds net.

10. The cement shall be stored in such a manner as to permit easy access for proper inspection and identification of each shipment, and in a suitable weather-tight building which will protect the cement from dampness.

IV. Inspection

11. Every facility shall be provided the purchaser for careful sampling and inspection at either the mill or at the site of the work, as may be specified. At least 10 days from the time of sampling shall be allowed for the completion of the 7-day test, and at least 31 days for the 28-day test. The cement shall be tested in accordance with the methods hereinafter prescribed. The 28-day test shall be waived only when specifically ordered.

V. Rejection

12. The cement may be rejected if it fails to meet any of the requirements of these specifications.

13. Cement shall not be rejected on account of failure to meet the fineness requirement if upon retest after drying at 100° C. for one hour it meets this requirement.

14. Cement failing to meet the test for soundness in steam may be accepted if it passes a retest using a new sample at any time within 28 days thereafter.

15. Packages varying more than 5% from the specified weight may be rejected; and if the average weight of packages in any shipment, as shown by weighing 50 packages taken at random, is less than that specified, the entire shipment may be rejected.

FREIGHT RATES ON CEMENT

The Newaygo Portland Cement Company of Newaygo, Michigan, has filed a complaint with the interstate commerce commission concerning freight rates charged by the Pere Marquette and nine other railroads. Rates on cement to northern Michigan, Wisconsin, and Minnesota are specially complained of. It is charged that they are discriminatory in favor of manufacturers in the two latter states.

Constructing Concrete Curbs

Experience of the Author in Developing a Satisfactory Form of Curb and Sidewalk to Resist Fracturing at Corners.

I notice on page 219 of the issue of February 18, 1916, of Municipal Journal, an article by City Engineer Gehres of Akron, Ohio. In his article mention is made of the very large number of feet of concrete curb laid in 1913, 52,979 lineal feet and only 9,309 lineal feet of stone curb, whereas in 1914, 79,031 feet of stone curb was laid and only 18,731 lineal feet of concrete curb and gutter. Mr. Gehres follows by stating that many complaints had been made against the concrete curbing, so that the property owners were willing to pay 50 cents for a stone curb and an additional 33 cents for concrete gutter in place of 55 cents for a combined concrete curb and gutter, and that generally speaking the property owners are demanding stone curbing instead of the concrete because of the defects in the building of the concrete curbing.

The writer has had considerable experience in the building of concrete curbing, the laying of sidewalks and the building of street pavements. Where concrete curbing is properly made there is little question that its general appearance is much better than any except the best dressed granite. It is also true enough that it is not so much the fault of the concrete as the fault of those using it that caused failures of concrete curbing. Winter as well as summer tries out con-

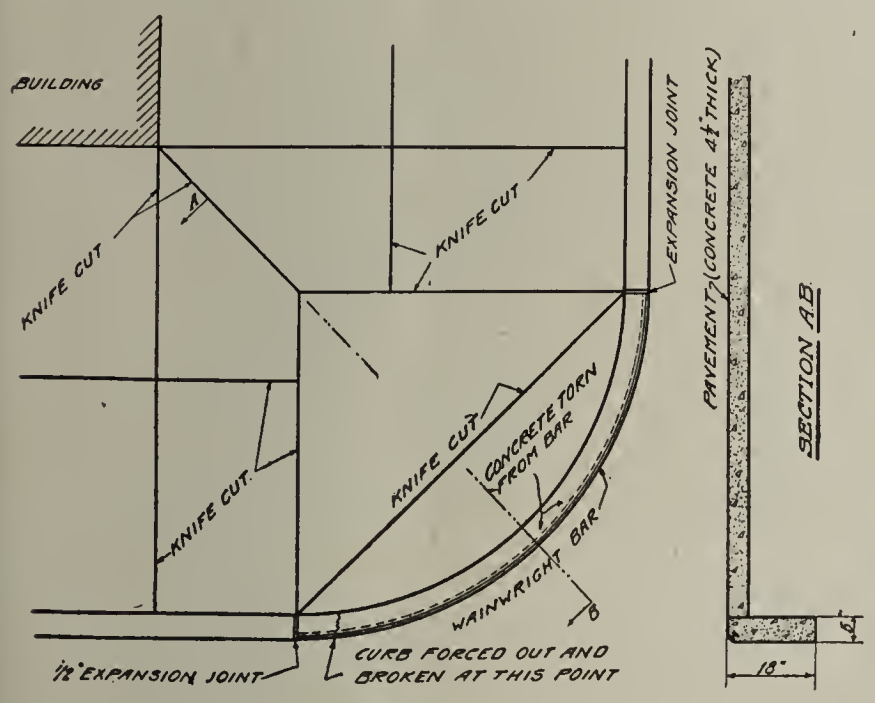

Fig. 1. First Design for Standard Corner.

crete curbing, so that each passing season has its effect. Then the conditions under which a curb was built has everything to do with its lasting qualities.

The following sketches and information show the manner in which a satisfactory concrete curb and sidewalk can be constructed at street intersections, which is one of the most important points for consideration.

In preparing plans for street work, including curb and sidewalks, an engineer should not forget that a street is constantly called on to withstand:

First—The action of the elements: heat—causing expansion; cold—causing contraction; with the corresponding action of all bodies surrounding the said street, etc., whose forces are exerted in lines tending to disrupt the structure. A street may or may not receive a great deal of traffic, but when the wear and tear of traffic are added to the forces already at work it is readily understood that a street is constantly worked day and night. Hence, unless the greatest care is observed during construction and the very best material selected, it is more than likely that neither street work nor curb will be satisfactory.

Concrete is more open to attack from atmospheric conditions than many other materials. Its contraction and expansion far exceeds that of stone. It is more porous and hence subjected to greater internal stresses from heat and cold.

From his own experience, however, the writer is personally in favor of concrete curb over stone. More even and prettier work can be had. It maintains its line better. It gives a better line to work concrete pavements to, grass and weeds will not grow so readily between its joints.

The weakest point of a concrete curb is at street intersections, and many towns have been trying to get a concrete curved curb that could not be pushed out and would not break up from the expansion in a sidewalk between blocks.

After many trials a standard design is now used by the writer. The radius used is 6 feet whenever possible. Fig. 1 represents the first curved curb used. The Wainwright corner bar was used and a half-inch expansion joint placed at each end of curve. At the end of the first year this curb was broken all to pieces and the corner bar shoved into the street. The curb was 5 inches thick throughout and 18 inches deep. Specifications in each case were the same.

Fig. 2 was thickened at the top to 6 inches and made 7 inches at the bottom. The depth of the curb was 18 inches, the batter, made on the outside of the curb, being 1 inch in 18 inches. This curb was also reinforced with two 1-inch twisted steel bars placed 6 inches and 12 inches below the top of the curb respectively, and in the center of the curb. A three-eighths-inch expansion joint was left at the tangent points.

The steel extended into the straight curb 18 inches. The face of the curb was also lined with the Wainwright bar. The force of the expansion of the sidewalk tore the Wainwright bar loose, split up the concrete and cracked the curb off at the end of the steel in the straight curb, which necessitated taking out the curb and replacing it, as it was dangerous to pedestrian as well as vehicular travel.

Fig. 3 shows the next step taken to overcome the expansion of the sidewalk where the workmen had failed to leave joints or sufficient joints. A 1-inch expansion joint was left immediately back of the curb proper at the corner, the curb being made the same in all other respects as before. In this instance the asphalt strips were squeezed out. The circular part of the curb was cracked in many places and one end was raised up in the air about two inches, causing people to trip over the same. Parts of the concrete sidewalk directly back of the circular part of the curb spawled off 1 inch thick and 6 inches long. Hence it was necessary to replace the corner. This occurred where the buildings along the street were brick or stone and the sidewalk had to move out or push the building back; the curb between squares raised the end of the curb at the tangent point. One would hardly

have believed these conditions unless they had personally observed them.

Fig. 4 shows the successful concrete corner. The curb proper and its protecting ledge must be made in one piece and should not be less than 3 feet wide at the center of the curve. The expansion joint should be placed where shown by the double lines and the concrete made thicker, as shown. This will successfully resist the pressures through the square, although

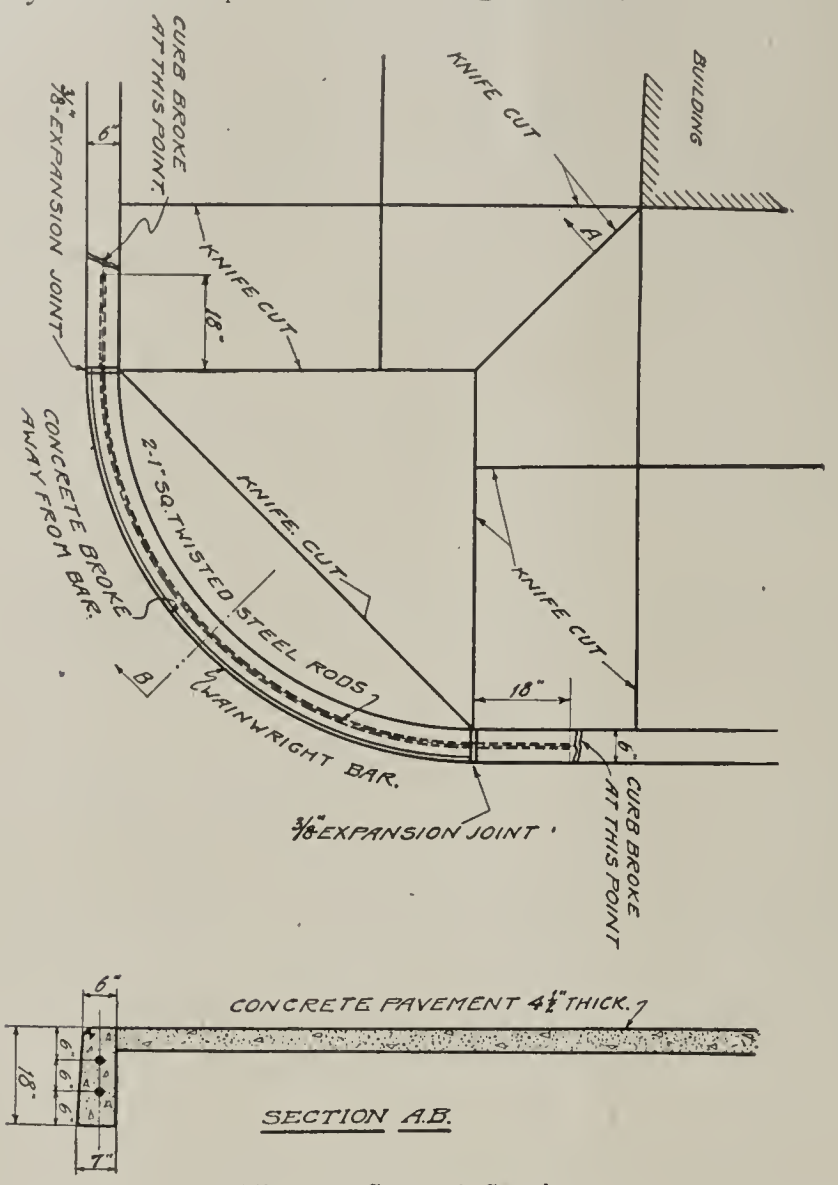

Fig. 2. Second Section.

occasional spawling results where the expansion joints are shown. The material used in making the joints should be a made-up strip of asphalt and not a poured joint. The expansion of the concrete will gradually close up this wide joint. You will note that the curb is made 18 inches deep, the protecting ledge 12 inches deep and the remainder of sidewalk ordinary thickness.

The building tends to crack the concrete along each line or face. This is cared for by the expansion joint and should be kept in mind.

All the concrete should be laid at one operation. The steel edge should be maintained to guide wagon wheels. The expansion joint should also be placed along the outside of curb next to street pavement, as shown. Provision is made for expansion of sidewalk and street in this manner.

The specifications call for concrete mixed one part cement, two parts of sand and four parts of stone, except the last two inches of top. This is put on before the lower 16 inches of curb has begun to set and is mixed one part of cement, one part of sand and two parts of trap rock screenings without dust. The stone used for making the body of the curb must be retained on a half-inch mesh and pass a one-inch mesh. All the screenings must pass a one-half inch mesh.

The straight curb is made in 8-foot lengths when no corner bar is used and in 10-foot lengths when the same is used.

The curb is covered with boards until it hardens. Mud, sand, or other earth is then placed on top and kept wet for four days.

As soon as the forms are removed, when the concrete is not over forty-eight hours old, a mixture of cement and screened stone-dust, in equal parts, is skimmed over the surface and trowel rubbed to smooth face.

No trouble has been experienced with any straight curb when the joints were made three-eighths-inch wide and the cut made entirely through.

Herbert W. Hatton,
Wilmington, Del.

EXPANSION IN CONCRETE SIDEWALKS

The letter from Mr. Hatton given above details what has in general been the experience of a great many engineers, although few possibly have persisted in changing the construction until reaching one which has proved satisfactory. Concrete sidewalks may be generally divided into two classes with reference to expansion troubles—those in which there is a strip of earth between sidewalk and curb, except at street intersections, where the sidewalk pavement is continued to the curbs (this is shown on the accompanying plan); and those in which the concrete sidewalk covers the entire surface from the buildings on one side to the curb on the other. In the latter construction there will almost invariably be a durable pavement on concrete foundation extending across the roadway from curb to curb, while such pavement may or may not exist in the other case.

Concrete expands by an appreciable amount under the effects of either heat or moisture, late investigations indicating that moisture has even more expansive effect than heat. This tendency to expansion is very powerful and yet not irresistible, as is seen from the fact that a continuous mass of concrete extending from building line to building line across the street could not expand without moving the walls of the building, which it apparently does not do. In such cases there is, of course, an internal compressive stress produced by the pressure of the structures which prevent the expansion. In the first class of pavements

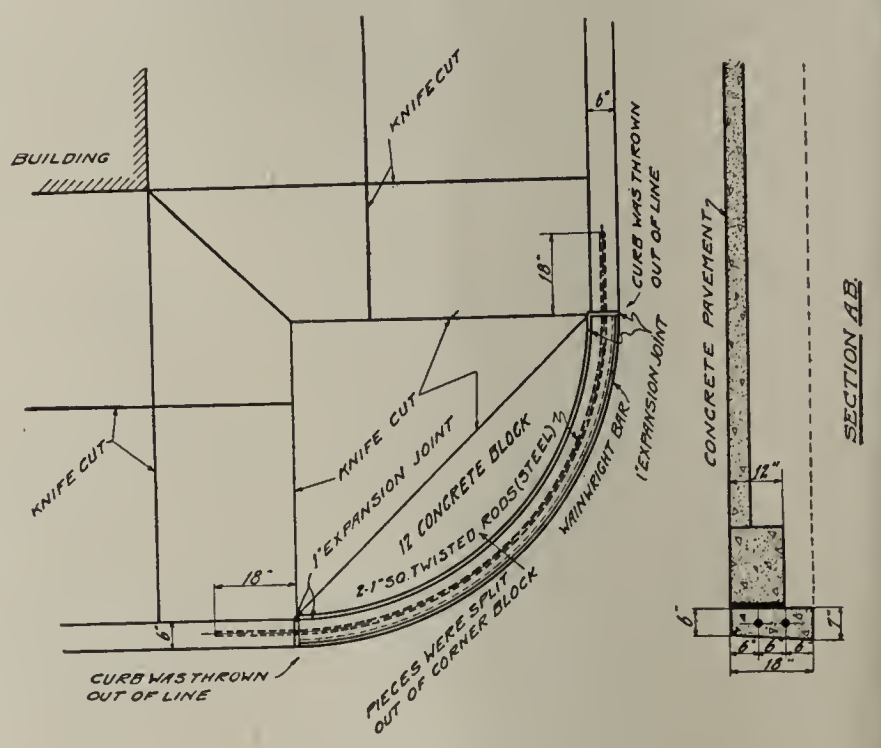

Fig. 3. Third Section.

referred to above, the sidewalk tends to expand and the longitudinal expansion is resisted only by the curb across the end of the sidewalk. If this is not sufficiently strong and well anchored to resist the force of expansion, it is pushed outward. When the sidewalk contracts again, the tendency is for each block to contract individually, widening the joints between blocks, which then fill with dirt, small stones, etc., which tend to render permanent this widening of the joint. When

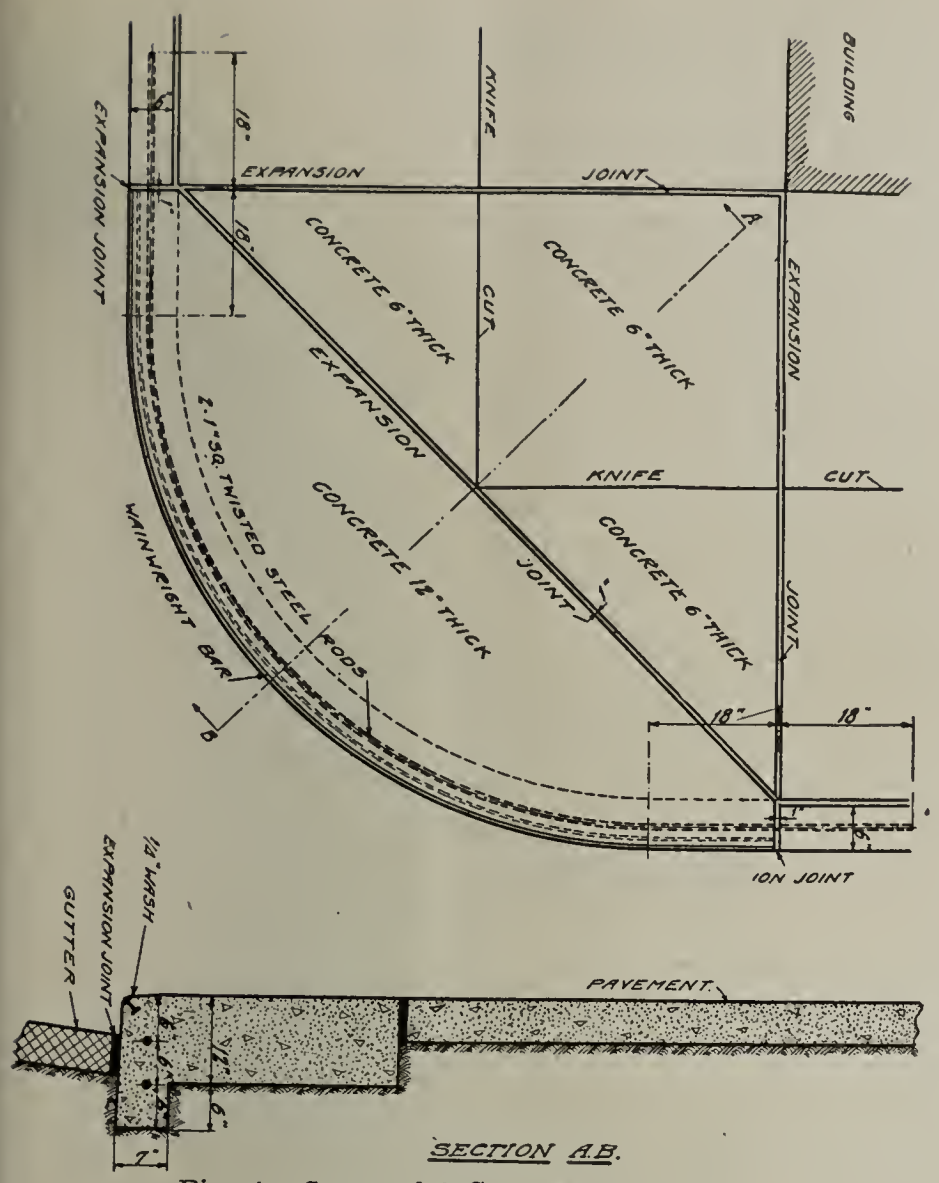

Fig. 4. Successful Concrete Corner.

the pavement next expands, it therefore pushes the end section a little further, and so by small increments the end of the pavement creeps gradually further and further from its original position. It would seem therefore that either the curb at the end of the sidewalk must be sufficiently strong and well anchored to resist the thrust of expansion, or it must be allowed to move, with serious detriment to its usefulness and appearance. There is, however, a third alternative, that of so designing the construction that the expansion may expend itself in some other less objectionable direction. Such an idea is indicated in the sketch, Fig. 5, in which the pavement is cut into two wedge-shaped blocks adjacent to the intersection. The two heavy blocks at the corner furnishing considerable resistance, which is greatly assisted by the foundation of the roadway pavement, these two wedge-shaped pieces marked c c will have the tendency to move inward from the curb, which movement is resisted only by the soil, which resistance would presumably be considerably less than that offered by the corner pieces. Weak points in this construction would be the acute angles caused by the diagonals, but this point can be strengthened by beveling the edge of the pavement so as to give the pointed end of the block a triangular rather than a knife-edge section. This beveling of the edge would also assist somewhat in permitting the blocks to move as intended, by causing the earth to slide up the inclined edge. This would, of course, throw the wedge-shaped blocks slightly out of line, but this would not be nearly as objectionable as the same amount of movement in the curbs. A strip of thin metal left in the diagonal joints would facilitate this movement.

Another method of treating the problem would be to carry the sidewalk pavement continuously to the face of the curb, as shown in the lower cross-section in the sketch, resting it upon the concrete or other gutter material, which at this point is carried back under the curb; placing a joint of about a sixteenth of an inch of tar between the under side of the sidewalk concrete and the gutter, which tends both to make this joint watertight and also to permit sliding under temperature expansion and contraction. Reinforcing rods would then be carried back through several of the sidewalk sections, being especially well anchored near the curb line so that movement of the sidewalk due to expansion should not be permanent. With such construction the face of the sidewalk in line with the curb would move very little out of line. Should this movement become objectionable in amount, the concrete could be cut back and refaced at comparatively small expense.

Probably the simplest method of attempting to overcome all of this expansion trouble is to use expansion joints. These have, we understand, given satisfactory service in some cities, but owing to the comparatively weak resistance to expansion offered by a light curb, we anticipate that under many conditions it will not prove a sure remedy.

The second case, that of a sidewalk continuous from building to curb, is the most difficult to treat, because here no motion is possible without overthrowing the curb, except such as is provided for by open joints, whether filled with expansion material or not. The force exerted against the upper edge of a curb by such a sidewalk and a similar force exerted by a concrete roadway foundation at about mid-depth, can be successfully resisted only by the strongest curbing, such as heavy granite or a very heavy concrete. In some cities this difficulty has been met by carrying the sidewalk concrete across the top of the curb, but the joint between the sidewalk concrete and the top of the

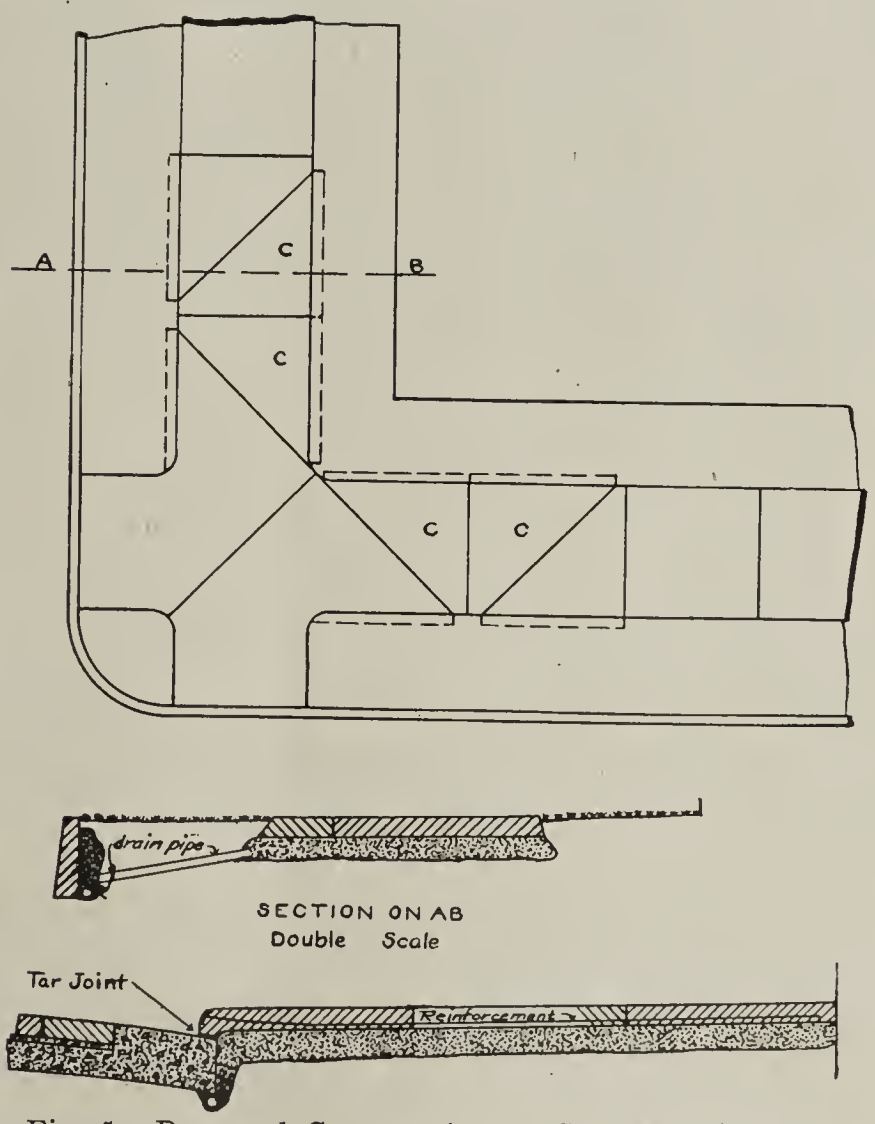

Fig. 5. Proposed Construction of Concrete Sidewalk.

curb is almost sure to weather or otherwise break into an open joint which is disfiguring and very apt to increase until the edge of the sidewalk becomes very ragged. What seems to us a more satisfactory plan has been adopted in a number of cases in both large cities and small towns. This is the construction shown in the lower section of the accompanying draw-

ing and already suggested a few lines above for the intersection of narrow sidewalk and curb. It consists in not using any curb at all, strictly speaking, but in finishing off the edge of the sidewalk so that it takes the place of the curb, this edge resting upon the concrete or other gutter as shown. (This assumes that concrete curb would be used and is sufficiently durable for this location. Should granite or other more substantial material be desired, the ordinary construction would of course be used.) Here also there would be a slight tendency to progressive motion due to dirt sifting into the joints when the pavement contracts, but this motion would not be considerable nor its result serious. If it is desired to avoid it, however. reinforcing rods could be used, tied back into the inner block. They could be anchored either by bending the forward end of the reinforcement, by using an anchor plate, or by anchoring the rod in a plate used for protecting the edge of the curb. In some cities the entire face of the curb, in streets where traffic is heavy, is protected by a steel plate extending from the gutter to the top of the curb, the reinforcing rods being provided with heads which are countersunk in the face of this plate. The strength of the reinforcement should be sufficient to overcome the friction of the sidewalk sliding on the cinders beneath it and on the gutter as it contracts to its original position. The cost of this reinforcement would be less than that of providing a substantial curb as in ordinary construction.

Curbs are often thrown forward by the expansion of freezing ground. This can be prevented by insuring that the ground behind the top half of the curb is kept drained. Where the ground is naturally sandy or gravelly, and there is any outlet for the ground water close to the surface, there is generally no trouble of this kind. Where the ground is of clay formation, however, it is desirable to place gravel, broken stone, clean cinders or some other material which will readily allow water to pass through it, from the base of the curb up to within an inch or two of the surface, placing on top just enough soil to provide for the roots of sod. It is desirable to connect this curb drainage, either continuously by a layer of gravel or at intervals of ten to thirty feet by small pipe, with the porous foundation provided under the sidewalk pavement to drain the latter. This construction will permit the water to drain to the bottom of the curb, but unless it is removed from there this will be of little benefit. Where the grade is fairly steep, all that is ordinarily necessary is to provide an outlet for this blind drainage system into the sewer catchbasins or whatever other outlet is available. It is safer, however, especially where such outlets are very infrequent or where the grade is quite flat, to place a small tile drain behind the curb at its base in order to remove the water which seeps to this point.

NEW CEMENT MILL OPENED

The new plant of the Texas Portland Cement Company, near Houston, Texas, was formally opened Tuesday. Several hundred citizens and visitors attended by boat, auto and special train.

The plant, which is located on the ship channel below Manchester, was in full operation, and there were experienced men on hand to explain every detail about the manufacture of cement. President F. R. Bissell and H. Struckman, consulting engineer, who designed the plant, and other officials of the company, who had come to Houston to be present at the opening, were there to greet the visitors.

PEERLESS SILO MOLDS FOR BUILDING COAL BINS

The contractor who is equipped with a good set of metal silo molds can tackle any kind of a round tank structure with impunity. Concrete silos and water tanks have come to be common objects of the country landscape, and now in the cities cylindrical coal pockets and grain elevators are going up.

A big double coal bin recently built for the Chas. Warner Company of Wilmington, Delaware, is illustrated herewith. The contractor used Peerless Silo Molds. The concrete cylinder measures 16 ft. in diameter by 70 ft. high. The walls are 6 in. thick. The owners state that it is proving very satisfactory.

One striking feature of this year's model Peerless Silo Mold is flexibility. The contractor starting out

with a small diameter mold can, at small additional cost, add additional parts that will enable him to build larger silos of all the different usual silo diameters. This feature of flexibility in the equipment added to the former attractive and practical features, makes these molds extremely interesting. They are furnished by the New Enterprise Concrete Machinery Company, 68 W. Monroe St., Chicago.

They state that in 1915 one Peerless operator built eighteen silos, twelve of them being 50 ft. high, two forty feet high, and two 35 feet high. Each one of these silos was built with a Peerless concrete roof. Only one set of forms was used, and this work cleaned up entirely in one building season. The builder who made this record is Mr. J. S. Mills, Momence, Ill.

NEW WATERPROOFING CATALOG.

Everyone interested in the waterproofing of concrete should get a copy of Medusa Waterproofing booklet, just off the press.

It describes Medusa Waterproofing powder and paste, explains the advantages of Medusa, and contains directions for use. It illustrates U. S. Government structures, pumping stations and municipal work, swimming pools, basements, concrete block buildings, burial vaults, etc.

Testimonials from enthusiastic users prove conclusively that Medusa Waterproofing is a positive preventive of dampness in concrete, and that permanent results are obtained.

Copy will be sent free on request. Write Department T2, The Sandusky Cement Company, Cleveland, O., and mention Cement & Engineering News when writing.

Economic Efficiency—Motor Trucks for Hauling

Building Material. The Transportation Problem Presents Two Outstanding Demands—Economy and Efficiency. To both of These the Motor Truck Has Furnished the Answer.

MORE MODERN DELIVERIES

The era of the motor truck for deliveries of building materials is upon us. Scarcity and consequent high price of horse flesh when taken together with the prevailing cost of feed has made the cost of team-drawn wagons much higher than it ever has been in the past. It is a cost that is sure to advance steadily, and as this is the biggest cost item of the dealer's service, all and each of them had better provide the best possible means of keeping an absolutely correct cost accounting upon team deliveries from this time forward. Motor trucks are rapidly becoming more numerous in the delivery of building materials. The builders have given a whole lot of study to the specific requirements of the dealer and several of them are now prepared to furnish the just right article. In some cases the application of motor trucks has amounted to the difference between a profitable and an unprofitable business, and the feature of new territory made available by mechanical transportation facilities is well worth the investment every time.

A hand power dump body mounted upon the chassis of a Standard truck, manufactured by the Standard Motor Truck Co., Detroit, Mich., which carries five tons in the service of M. M. Meeker, contractor, Minneapolis. Has replaced and is now doing the work of twelve horses and is hauling gravel at a cost of 7 cents per ton mile, or 35 cents for the load, which includes the cost of gasoline, oil, grease, supplies, depreciation, renewals, tires, interest on the investment, insurance, and garage, and as Mr. Meeker states in his last letter, "the expense has been surprisingly lower than anticipated."

These dump jobs are fitted with an automatic hydraulic hoist which can be attached to the motor, thereby operating automatically by the movement of one lever and automatically shuts itself off without the driver's attention, especially advantageous where a driver is not "onto his job" and forgets that the body has dumped its load and is ready to be put back into its original position.

In illustration the following incident is enlightening and timely:

"I hesitated a long time before deciding to buy a motor truck, but now I wish I had bought it six months—yes, a year ago." It was Astrid S. Rosing, president A. S. Rosing Co., building material, sand and gravel dealers, of Chicago, speaking.

"How much does it save me? About 20 per cent. You see, it replaces three teams and moves much faster than horses. I can give service with my truck—my middle name is service—it is so painted on the side of the truck. And since it helps me to live up to my reputation I am for the truck."

Thus, in a few short sentences, Mr. Rosing summed up his experience with a dump truck. Perhaps the best example of what his auto truck has done for Mr. Rosing may be found in the letting of a contract for the building materials on a job located in one of Chicago's north shore suburbs recently. After spending considerable time in drawing up the plans for the building and letting the contract, the architect suddenly decided that it was a rush job and must be finished in a hurry. Consequently orders were given the contractor to get the building up in record time, and to work nights, if necessary, to expedite the work.

Along toward the close of a busy day—in fact, it was about 5:30—the telephone bell rang in Mr. Rosing's office. The contractor for the north shore building was on the wire and wanted some material in a hurry. He was planning to work his men that night and they must have some material. The building was a large operation, and although the business offered by the contractor was only for a part of the material, the order was very attractive.

Mr. Rosing was asked just how soon the material could be delivered on the ground.

"In a half hour," was the reply.

And so a small order was placed, with the understanding that the time required to make deliveries that evening and the next day would be carefully checked, and the order increased or further business refused, depending upon the promptness with which the material was delivered.

That was 5:30. At exactly 6 o'clock the material was being unloaded from Mr. Rosing's truck at the building site. The same promptness characterized deliveries on the following day, and Mr. Rosing was given a substantial order for more materials. Not only that, but he offered the service of his motor truck, and did help other dealers who were supplying material to the job, but who found, owing to their inadequate delivery facilities, that they could not furnish the material fast enough.

Here is an actual instance of the performance of a truck in the hauling of cement. Schaefer Brothers of Rochester, N. Y., found one afternoon that they were likely to be caught with 56 tons of cement at the freight station ,on which they would have to pay demurrage unless it were taken away that evening. At 5 o'clock they called up the local agents of the motor truck company and explained the situation. The latter was willing to tackle the proposition in the belief that his car could get the 56 tons of cement from the station to the warehouse of Schaeffer Brothers, three miles away, that evening. The result was that in 3 hours and 10 minutes, exclusive of the time required for loading and unloading, the cement was hauled to its destination.

Brubaker Brothers of San Dimas, Cal., have secured splendid results in the replacement of three teams of horses with a 3-ton motor truck. They run the truck on an average of about 75 miles a day, carrying cement and pipe, at a saving of about $2,000 per year.

The Howards Company of New Haven, Conn., dealers in supplies for construction work, replaced three teams with one 4-ton motor truck, which in one year showed a surplus over the maintenance and operation of teams amounting to $1,546.12. These people state also that if necessary their truck could take on the work of a fourth team.

C. Frank Williamson of Media, Pa., a dealer in building materials, uses an auto truck to advantage for quick deliveries and finds it a surprising business builder. He at one time hauled 80 tons of crushed stone from two 40-ton freight cars on a Media siding to the grounds of a country club 1½ miles away. The distance was not great, but the fact that the power truck completed the work in two days shows its possibilities for quick hauling.

OPINIONS ON THE QUANTITY SYSTEM OF ESTIMATING

For years we have been advocating "The Quantity System of Estimating" says "The National Builder" and it is gratifying to know that Builders, Contractors, Architects and those about to build, recognize the benefit of this system, and are to a large extent growing more favorable to its general adoption, and that the question of its universal practice is taking a firmer grip than ever before on the public mind. The Building and Architectural press is also beginning to discern the merits and demerits of the subject, in an earnest manner, a fact which is sure to create good results and nothing could be more preferable to the parties concerned in any structure than this system if properly and honestly applied.

Mr. D. S. Ballantine in the Building Age, in writing on the "Quantity System," says: "From personal experience of the 'Quantity System,' I can assure the reader that by its adoption the contractors of this country will greatly benefit themselves and generally raise their standard of business. There is no reason why we should not wish to profit by the experience of others, and establish a universal method of estimating on the principle of the Quantity System as practiced successfully in London, revised and adjusted as may be found necesary to meet the requirements of this country, and forming the basis of an American System as advocated by G. Alexander Wright of San Francisco, and others. The length of time, the labor involved and the precise method adopted by the Quantity Surveyor in the preparation of the bill or schedule are immaterial to the contractor, and would not concern him any more than do the time and labor necssarily employed in preparing the drawings by the architect."

A comprehensive and intelligible Bill of Quantities, defining the exact amount and description of the materials and labors, guaranteed to the contractor and forming part of his contract, would be of inestimable benefit. The necessity of taking off his own quantities, and the consequent expense, loss of time, and inevitable risk of errors are avoided. A few minutes perusal of the drawings at the office of the architect in order to familiarize himself with the style and nature of the proposed structure, a visit to the site, pricing the bill and extending would constitute the entire work of the estimator.

"By a concentrated and honest effort on the part of the more representative contractors of the country, through their associations, the Quantity System might be well established, and I think it reasonable to assume it will receive the support of the architectural profession. Considerable has been written in its favor, and from a practical test it is understood to have been so far successful. All radical changes take time to accomplish, and their first efforts may not always wax enthusiasm. The cause is an excellent one, however, and must and will succeed, and it should receive the support of every contractor's association throughout the country, and the interest of the individual member. By establishing classes for the training and preparation of Quantity Surveyors, a great deal would result toward furthering the scheme, and it would be interesting to many to hear through these columns that some such move is being made in that direction."

As a matter of fact, contractors undertaking large works frequently employ skilled men of experience to make up their estimates before sending in their tenders for work, and they find it relieves them from a great deal of inconveniences and worries, besides that feeling of uncertainty and doubt which always haunts the builder who makes up his own estimates. When an expert is employed to make up the figures on a job, he is supposed to know of everything that is required to complete it, and it naturally follows that no item of work or material is overlooked, and this gives confidence to the contractor, with an assurance that everything on the work has been accounted for. The Quantity Surveyor makes it his business to learn the prices and cost of everything he deals with, also the cost of transportation, moving earth, excavations, scaffolding, hoisting machines, and other tools and appliances that may be employed temporarily or otherwise on the works; and will know how to charge for their uses while on duty. To become a successful Surveyor and Estimator, a man must be more than an ordinary man, and possess a broad knowledge of arithmetic and geometry, and a familiarity with the building trades in every branch. That will take time, money and close application to acquire.

G. Alexander Wright, of San Francisco, Cal., who was the pioneer in this country in the movement in aid of the quantity system and better contract methods:

"The movement urging the adoption of the quantity system in the United States was commenced in San Francisco early in 1891. This movement has continued down to the present time. Its object has never been, and is not, to profit financially, but to promote better contracting methods between owner and contractor, solely because they are better. Neither the movement nor its promoter indorses any firm or individual as is commonly supposed, as suggested.

"Considerable interest has been aroused in the United States as a direct result of these long continued efforts. Much of an educational value has been acomplished. Those, however, who have the future adoption of the quantity system really at heart (and not because of the business it may bring them) realize that

much more preliminary and gratuitous work must be done before the advantages of the quantity system can be fully understood and appreciated by contractors and owners.

"Unfortunately, however, as is so often the case (when likely-looking prospects appear upon the business horizon), the commercial spirit, the dollar desire which cannot wait, has been aroused, and we already have business enterprises advertising their wares, their material lists, or what not, from a few dollars up. Then, again, during the last year or two there have sprung up, principally in our larger Eastern cities, certain self-styled exponents of the quantity system, some of whom, it is safe to say, have no practical experience of the quantity system, and herein lies a danger before us.

"It therefore behooves the conservative admirers or advocates of the quantity system to mark time and not be too ready, at least for the present, to allow the use of their names as advocates of the immature, faulty and varying methods adopted by firms, bureaus or individuals, who, to get business, are far too ready to make claims for their so-called lists, quantity surveys, unit items or whatever name the promoters invent to attract customers. It is sufficient to say that such methods are not those of persons educated in the practical operation of the quantity system, and which is the only standard method which possesses any advantage over the contracting practices of to-day. The 'quantity system' is the proper term to use, and it possesses a greater significance than anything else."

MECHANICAL CONVEYORS CUT HANDLING COSTS.

Modern efficiency ideas are responsible for the development of mechanical handling of raw and finished materials in mills, factories and warehouses. Because hand labor is so slow and expensive, concerns in every line of manufacture have given interested attention to ways and means for eliminating as far as possible the human equation in moving materials, realizing that mechanical means, wherever applied, meant increased speed and reduced labor cost.

The Jeffrey Manufacturing Company of Columbus, Ohio, have developed conveyor systems to meet the requirements of practically all industries, and it is the purpose of this article to illustrate and describe some

Fig. 1.

standard types of portable conveyors and stackers for the handling and piling of bags, barrels, boxes, bales, etc.

Figure 1 shows a Jeffrey Portable Sectional Belt Conveyor installed by the Standard Oil Company at their De Voe works, Long Island City, N. Y., for handling cases of oil from shipping room to lighters and thence to vessels for shipment to foreign climes.

The conveyor is 140 feet centers, built in seven sections of 20 feet each. The belt is 18 inches wide, and at 125 feet per minute travel has a capacity of 1,500 packages (weighing 80 pounds each) per hour, when spaced every five feet on the belt.

Both the head and foot shaft of each section is fitted with a sprocket for driving the section following, ample guards being furnished for all gears and chains.

Fig. 2.

While the driving section in this instance is provided with a motor mounted on a steel frame with sufficient clearance to allow the largest packages to pass under, the motor and gearing may be placed in the clear beneath the belt. This drive section can be placed at either end or at intermediate points.

The flexible jointed bearings of the conveyor rolls insure a minimum of power consumption, only a 5 H.P. motor being required to drive the entire conveyor. The channel stringers are mounted on large ball bearing castors, making the movement of the sections very easy.

These portable sectional conveyors are built in any consistent lengths or widths for the handling of bags, boxes, etc.

Fig. 3.

The Jeffrey stacker not only saves time and labor, but greatly increases warehouse capacity by allowing higher piling, as delivery can be made from a minimum height of 6 feet to a maximum of 14 feet 6 inches, bags and boxes weighing 340 pounds being handled as fast as three men can take them from the discharge point.

Being mounted on ball bearing swivel castors, the stacker is easily pushed about by two men. The steel boom is fitted with wood flights mounted on two strands of roller chains, reducing friction. A 3 H.P. motor is ample for driving.

Literature fully illustrating and describing their portable conveyors and stackers is now being prepared by the Jeffrey Manufacturing Company, and will be

sent to anyone interested who will write to their home office, 914 North Fourth street, Columbus, Ohio, or to their branch offices or agencies.

Another Jeffrey labor-saving device is illustrated in Fig. 2 above, showing a portable conveyor which handles 500-pound barrels at the rate of 180 per hour.

The two points of discharge of 5 feet and 8 feet above the ground not only allow the loading of barrels to car floor or shipping platform, but the stocking of one tier upon the other.

A unique feature of this conveyor, whereby a minimum of power is required for the service performed, is the engaging of the barrel after it enters the guide ways, by cross bars with rollers. Not only are the barrels rolled up the incline and not dragged, but the cross bars have their friction reduced by rolling on the barrel; the whole scheme being a minimum of rolling parts.

A two horse-power motor is required to drive the conveyor, whose rigid steel frame is so balanced on 36-inch wheels as to enable one man to move the machine.

The application of this conveyor extends to a wide range of industries such as bakeries, breweries, cement mills, flour mills, glue factories, paint works, salt works, sugar refineries, warehouses, docks and storage where barrels in any quantities are to be handled.

Of the various types of stackers which have been placed on the market, the Jeffrey stacker is essentially one for heavy duty and yet one of light weight, each piece of material in it being so placed as to give a maximum of service for the duty performed.

While primarily designed for handling miscellaneous freight upon its 24-inch apron, the machine as illustrated in Figure 3 is shown handling bags into and out of storage.

HAVE YOU A " LITTLE GENERAL" ON THE JOB?

The big question in the contracting field is how to lessen labor costs. Profits are raised when costs are decreased, and every contractor owes it to his business to apply those methods which help boost the bank balance.

There has been ample room for improvement in the methods of hoisting material. The plodding hod carrier never figured as an investment—he represented a

mighty big expense, and a mighty slow method. And what was true in carrying brick applied equally to getting other material from the ground to where it was needed.

So—exit the hod carrier and enter the "Little General" Elevator! It sounds big to state the "Little General" will save 25% of time and labor in erecting a building, but actual use has proved the statement true. It will easily keep from twelve to fifteen bricklayers supplied with material, and the same economy applies to concrete construction. Whatever material requires to be elevated can go via the "Little General" route quicker, and with less expense, than any other method known.

A contractor can dispense with several laborers directly the "Little General" comes on the job. This explains how its cost is completely saved after being used on two or three contracts. It is easily and quickly erected, and is equally simple to take down, move or store. A "Little General" outfit includes carts of a new type, which are built for quick and easy operation.

We understand the "Little General" is furnished on a thirty days' trial. Full information can be obtained by writing the H. B. Sackett Co., 1679 Elston ave., Chicago.

A KANSAS CEMENT COMPANY TO REORGANIZE

The reorganization of the Altoona Portland Cement Company, Altoona, Kansas, by the formation of a new company to save the stock of the bankrupt corporation was recently placed in the hands of a committee of five bondholders and creditors. J. L. Hecht of Davenport, Iowa, is chairman of the committee.

When the case was in court in Kansas City, the court of bankruptcy ordered the sale of the property of the Altoona company unless the bondholders and creditors devised a means for raising credit and paying off the accumulated debts of the concern. At a meeting of the bondholders for the purpose of conserving their interests in the company and preserving the property of the bankrupt, it was decided to effect a reorganization by organizing the new company, preferable to the loss by sale of the property.

Preferred stock in the new company is to be issued to the bond holders and creditors in sums and amounts equal to their holdings, with accumulated interest. This is the function of the above mentioned committee of five.

CONCRETE PRODUCTS PLANTS FOR SAND AND GRAVEL PRODUCERS.

The problem of utilizing the spare time of his employes has been solved by Mr. E. A. Baker, a shipper of sand and gravel at Noblesville, Ind., in a novel and at same time practical manner. Mr. Baker has established a plant for the manufacture of concrete products. This is an idea which could well be adopted by other sand and gravel plants. Such a plant would enable the dealer to retain the services of his employes during dull times, keep in his employment experienced and efficient help and have at all times sufficient number of men to operate his gravel plant. The time of the men can be utilized to good advantage during weather that would not permit outside work, or during delays from any other reason. The initial investment need not be large and can be readily increased as the possibilities for the manufacturing of concrete products improve.

Obtaining his aggregates at the cost of production only, the gravel dealer has a decided advantage over the concrete products manufacturer who must purchase his aggregates from the dealer. Influenced by these considerations Mr. Baker has erected a small concrete products plant near his gravel pit and has installed up-to-date equipment for the manufacture of blocks, fence posts, culverts, drain tile, sewer pipe, and burial vaults. The plant is equipped with steam curing chambers to insure a uniform and properly cured product. Mr. Baker is convinced that this concrete products factory can be made a paying adjunct to his sand and gravel business.

CEMENT SAMPLING AND SOME CEMENT PECULIARITIES

By Bernard Enright*

In the testing of cement, in common with the subject of testing in general, for that matter, the first point of vital importance to be taken care of is to see that the sample taken is thoroughly representative of the material to be reported upon. The stereotyped expression that a sample which is not representative of the lot is worthless, by no means fits the case. It is decidedly worse than worthless; the results from such a sample are liable to be false, in so far as they are supposed to represent the material, and therefore misleading; and it is certainly better to have no opinion whatever of the quality of any lot of material, than to have an incorrect opinion of it. In the latter case, an injustice to the manufacturer, on the one hand, or to the engineer or consumer, on the other hand, is bound to result.

It is encouraging, then, to note that in connection with the investigations at present being conducted, bearing upon the possibility of revision of the standard requirements for cement, the subject of sampling is being given consideration.

One point, however, which unfortunately appears to be receiving no attention, is the protection of the sample in the interval between sampling and testing. While ordinarily, particularly where the testing is started practically immediately after the sampling, this point may be considered more or less unimportant, it assumes considerable importance in cases where there is a long interval between sampling and testing, as may be necessitated by shipping the sample some distance, for test, Without enlarging on this point here, it might be stated that the condition the writer has in mind is the liability of small samples of some cements, originally slow-setting, to turn quick-setting upon storage, the change sometimes occurring over night. The same cement, stored in bulk in the stock house, will remain slow-setting for months, or indefinitely, and the same is true of the sacks of such cement, in car shipments, although, of course, undue exposure to the hot rays of the sun for an unusual length of time may quicken the set of most cements in sacks.

The writer has known cements of absolutely first-class quality in every respect, as shown by analyses and long time physical tests as well as by their behavior in concrete, to show this peculiarity. The phenomena is not confined to low lime cements, some of the cases noted being of cements over 63% in lime content; nor is it confined to any particular brand or even to any particular locality. While they are of very frequent occurrence, the fact that they do happen occasionally exposes the manufacturer to the danger of an unfair condemnation of his product if the engineer conducting the test on such a sample is unaware of, or takes no cognizance of, this possibility of a sudden change in the setting time of the small sample.

In one case within the writer's observation, concrete work on a large structure was temporarily stopped, on instructions issued by an engineer of tests, who reported the cement quick-setting. It gave no such indication in the concrete, and a re-sample and re-test showed the cement to be of normal slow-setting quality. In another case, a car of cement was condemned by a laboratory located several hundred miles from the cement plant, and from the destination of the car, the sample forwarded the laboratory having turned quick-setting either during transportation to them, or in the laboratory prior to test. This car, after most rigid tests by the city engineer, was then used in municipal work in one of our large cities, and the concrete, which was placed nearly ten years ago, is at present, as was to be expected, absolutely hard and as nearly perfect as it is possible for concrete to be, in every respect.

In the matter of car sampling, an individual sample from a sack is liable to represent that sack only. Of course the greater the number of sacks represented the more nearly representative of the car would a composite sample, from these sacks, be. On this basis, sampling from one sack in every twenty would be a better sampling system than one sack in forty, or one sack in eighty, while a small sample from each individual sack would represent the best practice.

It is ordinarily not practicable to take a sample from each filled sack. Attention might be drawn to the fact, however, that nearly all the automatic packing devices in present use in the cement industry, permit the obtaining of a practically continuous sample, representing each individual sack filled, during the loading of a car, thus yielding an ideal sample to represent each car as soon as the last sack for the car is filled.

Most of the cement plants which the writer has had occasion to visit within the last year or two, both in this section and in the west, are taking advantage of this fact, and are obtaining their car samples in this manner.

*Directory Eastern Testing Laboratories.

CONCRETE TELEPHONE POLES

The Universal Cement Products Company, Continental Commercial Bank building, Chicago, a $1,500,000 Delaware corporation, recently organized for the manufacture of hollow concrete telephone, telegraph and decorative lighting poles.

The company already is well supplied with contracts and is turning out its materials in a Milwaukee branch factory. Five manufactories will be installed in different parts of the United States as soon as desirable locations are secured for them.

DEATH OF MR. H. B. ELDRIDGE.

It is with deep regret we announce the death of Mr. H. B. Eldridge, sales manager of the Bradley Pulverizer Company of Boston, manufacturers of the Giant Griffin Mills and the Bradley Hercules Mills for pulverizing cement clinker, cement rock, coal, and all other refractory substances.

Mr. Eldridge was connected with the Bradley Pulverizer Company for 25 years and was one of the best known salesmen in the cement industry, having sold Griffin Mills to the pioneer cement manufacturers in this country. He was a man of exceptional character, one that was honored and liked by every one with whom he came in contact and was known wherever pulverizing machinery has been used.

75,000 TON BLAST

This blast was made recently in the H. Frazier Quarry, Fort Spring, W. Va. The quarry is a horizontal bedded limestone of varying hardness. The top layers are weathered and comparatively soft, while the lower strata are quite hard and white limestone. The height of the face varies from 15 to 175 feet and the quarry is being worked mostly on the full face plan. They do some bench shooting but are squaring up the face to make it vertical for "well drill" blasting.

During the early part of May a large blast was made at this quarry consisting of fifteen 6-inch holes. All but two of these holes were about 125 feet deep and extended about 5 feet below the quarry floor. The two short holes were 72 feet and 85 feet deep respectively. All holes averaged about 15 feet apart with a burden at the top of 8 to 12 feet and a burden at the bottom of 25 to 35 feet.

Cyclone Big Blast Hole drills were used, made in Orville, Ohio, by the Sanderson Cyclone Drill Company.

In each hole there was loaded from 400 to 500 pounds of Du Pont gelatin, 60 per cent strength, packed in 5x8 cartridges, and on top of this was loaded from 150 to 600 pounds of Du Pont quarry powder, packed in 5x8 cartridges. In each hole was placed a line of countered Cordeau to detonate the charge of explosive. This Cordeau was held taut while the cartridges, which had been slit once lengthwise, were lowered down the holes. In ten of the holes the charges were split near the center with from 10 to 20 feet of clay stemming between the two charges. On top of the top charge there was placed about 20 feet of clay stemming. In the five holes which were loaded solid there was about 30 feet of clay stemming on top of the charge.

To each line of Cordeau was attached one No. 6 Du-Pont electric blasting cap with 14 foot wires, by means of a special union made for that purpose. These electric blasting caps were then connected in series, tested carefully by means of the Du Pont Galvanometer to see that all connections were properly made before connecting to the No. 4 Pull-Up Blasting Machine. Everything being found alright, the blasting machine was operated by Supt. F. R. Anderson and a most successful blast resulted.

About 50 per cent of the stone was broken to one man size and none was thrown over 100 yards from the face. The following is a summary of the yardage, amount of explosives used, etc.

Average burden on the holes 2,000 solid cubic yards.
Total burden on the holes 30,000 solid cubic yards.
Average charge of explosives per hole 900 pounds.
Total charge of explosives used about 13,500 pounds.
Total amount of rock broken 60,500 loose yards or 75,000 tons.
Average 5.5 tons per pound of explosive.
Cost of explosives and blasting supplies $1,640.
Cost per ton 2.2 cents.
Cost of explosives, blasting supplies, drilling and loading $2,460.
Total cost per ton 3.3 cents.

CONCRETE WORK ON DULUTH, M. & N. RY.

As part of its 1915 improvement work the Duluth, Missabe & Northern constructed one 12x16 ft. concrete arch culvert to replace 2,600 of pile trestle, which was filled; two other wooden trestles were replaced by concrete slab trestles built on concrete piers; three wooden trestles were replaced by steel girder bridges with concrete slab decks and several small culverts were also built.

Strength the Essential in Concrete Aggregates

New Form of Specifications Offered Which Makes It Possible to Utilize Good Material Close at Hand.

By Cloyd M. Chapman, Engineer, New York, N. Y.

Instead of specifying that concrete aggregates, particularly sand, be of a certain fixed minimum standard of quality, which may not be attained in certain localities, it is proposed that specifications be made to read, in effect, as follows: "The materials used shall be of such quality, and shall be used in such proportions, as to produce a concrete which shall show a compressive strength of 2,500 (or 2,000 or 1,500) pounds per square inch at the age of 28 days, when tested in accordance with the standard methods of testing."

A brief outline is given of the manner in which this form of specification is utilized in practice by Westinghouse Church Kerr & Company and the method of checking up the quality of fine aggregates as they are received on the job, by the use of the sand tester.

Acceptable Specifications

To be generally acceptable, specifications for concrete aggregates should fulfill two requirements: (1) they should insure the production of suitable concrete if the aggregates are properly used, and (2) they should permit the use of materials found in the vicinity of the work, if such materials are capable of producing concrete of the required quality. The present method of specifying may insure the quality of the material, but it does not permit the use of a wide choice of aggregates from which first-class concrete may be made.

Present specifications for sand require that it shall, when tested as prescribed, show a compressive strength approximately equal to that obtained from standard Ottawa sand. A rigid adherence to these specifications would mean that in many sections of the country no concrete work could be done without importing aggregates from a distance. The result in that the specifications are ignored in those localities and the work is done without them.

On the other hand, where most excellent materials are available the present specifications for sand do not permit of variation of the proportions used, no matter how good the materials may be. Wherein lies the incentive to a contractor or builder to use any better materials than the cheapest, if he is compelled by the specifications to use a certain arbitrary mix, regardless of quality or material?

New Specifications Suggested

In order to cover and include all materials which are capable of producing concrete of the quality required for the particular service it is to perform it is only necessary to specify the result required instead of specifying the materials used.

Let it be assumed, for instance, that for mass foundations and footings, for retaining walls and abutments and for similar service a concrete which has a compressive strength of 1,500 pounds per square inch at the age of 28 days is suitable. For reinforced walls and matts where stresses are moderate a compressive strength of 2,000 pounds at 28 days may be required, while for reinforced floor slabs, beams, girders, columns, etc., a minimum compressive strength of 2,500 pounds per square inch at the same age may be necessary. By specifying the results required and permitting the use of such materials as will produce these results when tested under the specified and standardized conditions, it is possible not only properly to safeguard the products but to permit the use of such materials as are available in each locality.

In operating under such specifications it is of great importance that specimens of the concrete produced on the job be regularly made and tested. It is also of the greatest importance that a close check be maintained on the quality of the materials used, so as to insure a reasonable uniformity, and to know that these materials are at least equal in quality to the materials used in arriving at the proportions required to give the quality of concrete called for in the specifications.

The regular and systematic testing of the size of the aggregate gives data which will permit the engineer to tell without further tests whether the aggregates will produce a better or a poorer concrete than that produced by the original or standard sample. This fact is based upon the well-established principle that, other things being equal, the aggregate with a granulometric-analysis curve most nearly approaching the line of maximum density will produce the best concrete.

Among the tests made on sand are several granulometric-analysis guide charts made with a sand-tester. As the sand arrives on the job the inspector makes the test with the sand tester and compares the resulting chart with the guide chart. If the results show greater variation than is permissible, the matter is taken up with the one who supplies the sand.

Experience with this form of specification has shown it to be advantageous in localities where the available aggregates are not up to the standards now specified.

NEW CEMENT MILL FOR TENNESSEE

Details have been determined for the Portland cement plant which the Cumberland Mountain Minerals Co. has been preparing to build at Cumberland Gap, Tenn. This plant will have a daily capacity of 30 carloads of cement, and will represent an investment of about $450,000. Victor Buetner, Holston Bank Building, Knoxville, president of the corporation, writes:

"Will remove buildings and equipment of the Lumbermen's Cement Company's plant at Carlyle, Kans., to Cumberland Gap; rearrange and provide improvements to suit conditions; dismantling, moving, erecting and remodeling estimated to cost $200,000; cost of new equipment will be $250,000; daily capacity, 30 carloads cement; new machinery required includes three steam engines of 1,000 horsepower each, eight 300-horsepower water-tube boilers, three 600-kilowatt 60-cycle generators, 160 of 60-cycle type 5 to 200 horsepower motors, coal-burning equipment for kilns, two coal dryers, four 8x25 tube mills, two 60-ton steam shovels and two deep-well drilling machines."

CEMENT SHOT FROM GUN.

In order to waterproof the upstream face of the Elephant Butte dam of the United States reclamation service in New Mexico, a wooden raft was launched in the water of the reservoir formed by the structure and from it a mixture of cement, sand and water was shot on the face of the dam by means of a gun operated by compressed air. The coating was applied in horizontal strips about ten feet high and the length of the dam at water level. The mortar waterproofing coating was applied in four layers, each about one-fourth of an inch thick. Numerous samples taken from the face of the dam showed perfect adhesion of the waterproofing coat to the original concrete.

BATCH MIXER

Dunn Concrete Mixer with Large Tilting Drum Sold on 15 Days' Trial

The Dunn Concrete Mixer is a batch machine of the tilting drum type built with two capacities—No. 1 with a 5 cubic feet batch, and No. 0 with 3½ feet. The principal mixing features are the large open drum with four blades which produce a mixed batch a minute.

On the idea that the longer the travel the better the mix, the drum is made much longer than usual. The drum is designed to mix, not only hold, a batch of five cubic feet. The mixing is done by four blades, two placed at the back to throw the concrete forward and two at the front to throw it back. The position and operation of these blades, combined with the rotary movement of the long drum, is calculated to impart a sort of corkscrew motion to the concrete. This mixing allows no large particles to stay in front while the finer ones remain in the back. The length of the drum allows it to be set at a low angle, improving the mixing. This angle may be changed according to the dryness or wetness of the mix required. In the No. 0 machine this is accomplished by adjusting a brace on the leg which connects with one of the discharge levers. On the No. 1 the drum will automatically remain at the required angle when the operator stops turning the handwheel, or throws out the lever. The large opening allows the state of the mix to be seen at all times and permits easy cleaning. The top part of the drum is constructed of heavy boiler plate and the bottom of cast iron.

The long center bearing on which the drum revolves is carefully inclined so that vibration is minimized and operation smooth. The yoke supporting the drum is hollow and cast in one piece, making it strong and rigid. All gears are accurately machined and covered so as to be protected from dirt and to make them safe.

The mixer can be charged and discharged from either side while the drum is running, and mixing begins as soon as the material is thrown into the drum. When the drum is in position for charging the bottom is close to the floor, assuring a low shoveling height. While the batch, or any part of it, is being discharged, the drum does not stop revolving. The power discharge is a big saving in time and labor over the hand wheel. It is operated by a lever engaging the gears which controls the tilting of the drum in either direction and holds it at the right angle for mixing, these gears being directly connected to the engine. The hand wheel discharge is a feature of the No. 1 mixer, while levers are used on the No. 0 machine.

The frame on all the mixers is of cast iron, reinforced and braced, which together with the extra wide legs, assure strength and rigidity. The trucks are constructed of two steel channels bent, braced and reinforced, 5 inch on No. 1 machine and 4 inch on No. 0. The method of bending the two trucks together in the center permits of manipulation in small space and allows the wheelbarrow to be placed directly under the drum to receive the contents.

Power is from a four-cycle "Chicago" gasoline engine, 2½ h.p. on the No. 1 machine and 1½ on the No. 0. The engine is open jacket water cooled, of strong and reliable construction. The engine is enclosed all around with a heavy steel housing, assuring protection from dirt and dust.

The mixers described are made by the W. E. Dunn Manufacturing Company, 414 Twenty-fourth street, Holland, Mich.

NEW PLANT OF PEARL CITY GRAVEL COMPANY WILL SOON BE LOADING SEVERAL CARS DAILY

"Muscatine will be as much a gravel center as it is a button center if the present rate of development is maintained," said H. J. Jeffries, of the Pearl City Gravel company. The gravel pit of this new concern is located but a short distance below the city. Here the company has acquired about 25 or 30 acres and there is no limit to the amount of gravel that can be taken from this pit. At the present time with the switch track of the M. N. & S. alongside the pit it is well adapted to take care of the business. A large amount of the land has been opened up and the black dirt removed. The barge and pump have been placed in the pit and a large 50 horse power electric pump installed. The electricity is supplied by the local power company. On the barge is the motor and a six-inch Morris centrifugal pump that throws a solid stream of gravel, sand and water six inches in diameter. The gravel thus acquired is a high quality of washed gravel, the engineers who have tested it stating that it runs about 73 per cent. Many cars have already been sent out and the company is rapidly getting into shape so that by another year it will be turning out several car loads a day. The gravel is being used by cement contractors here and in other cities. The Pearl City people have purchased a large auto truck for delivery in Muscatine and vicinity and as their business grows will acquire other equipment.

OLD CONCRETE FOUND GOOD

Concrete in the New York subway, placed 10 to 15 years ago, has proved to be in very good shape in those locations where reconstruction work has made it necessary to cut into it, according to a paper by Robert Ridgway, Engineer of Subway Construction, read before the American Concrete Institute in Chicago. Some of the reconstruction work involved the cutting out of the original concrete in many places. Mr. Ridgway says that it is a satisfaction to state that there has been no evidence of any disintegration of the old concrete from electrolysis or other causes. Two pieces of concrete from the lining of the Park Ave. tunnel were cut out within the past few months, shaped into a 6x6x12-in. prism and tested for compression. One sample failed at 3,950 lb. per sq. in.; the other did not fail at the capacity of the machine, about 4,000 lb, per sq. in. This concrete was 13 years old, and the samples were selected as being rather below the average quality of the concrete being removed in the vicinity. In driving the shields for the tunnel which passes under the East River from Old Slip, Manhattan, to Clark St., Brooklyn, the Manhattan shields encountered the concrete foundation of the bulkhead wall that was constructed in 1905. This foundation was in the form of concrete deposited in salt water in burlap bags and was found to be in excellent condition. The burlap of the bags was intact in places, and the general appearance of the material was that of mass concrete placed in the dry.

MEDUSA WATERPROOFING.

30,000 pounds of Medusa Waterproofing (manufactured by the Sandusky Cement Company, Cleveland, O.) will be used at Ft. Wayne, Indiana, by Wells Brothers Co., general contractors of Chicago, in the construction of a building for the Ft. Wayne Electric Works, a subsidiary of the General Electric Co. Harris & Richards, Philadelphia, are the architects, and they specified the Medusa Waterproofing.

CONCRETE BURIAL VAULT INDUSTRY

The use of concrete burial vaults during the last few years has increased at an astonishing rate, reflecting a demand caused in part by the general development of the Concrete Industry—a demand for concrete products of all kinds. Then there has never been a period during which the undertaking profession has made so great progress in all departments as in the last ten years; consequently a much higher grade of funeral furnishings of all kinds are being used now than ever before, and therefore there has been an increased demand for a higher state of perfection in burial vaults. Then again the public in general are being educated out of the old-time method of burying with only an ordinary wooden box to protect the remains; and along with this educa-

tion has come a spirit of investigation as to what kind of burial vault is best, the result of all this being that the concrete vault is more in demand than any other.

The Automatic Sealing Vault Co., 216 E. River Street Peru, Indiana, has not been slow in realizing the truth of the above statements, and has spared neither time nor money in bringing the Automatic Sealing Vault up to the highest standard of perfection.

At the time this vault was invented, there were a number of two-piece concrete vaults, besides several sectional vaults on the market; but all belonged practically to the same class, as they all depended on having their different sections cemented together in order to make them water-tight—a process which is of doubtful efficacy for the simple reason that the chemical action which hardens a mass of concrete by causing the elements of which it is composed to crystallize is exhausted in the process; and any attempt to unite two or more sections of seasoned concrete with fresh cement simply results in a chemical action taking place in the fresh cement only, causing it to crystallize, but the sections are not united as there is no affinity in a mass of seasoned concrete for the elements of which it was originally composed. The fresh cement may cause the sections to adhere together; but the old joint still remains, through which the water, it is claimed, will eventually filter.

CONCRETING THE ATHENS SHAFT

Mr. R. S. Elliott, superintendent, has a plan for the concreting of the Athens shaft, at Negaunee, Mich., which will differ somewhat from the usual practice. He is thinking of putting in bearers each 100 feet when the shaft is to the point desired, about 2,400 feet below surface, and to pour concrete to these 100-foot sections instead of concreting from the bottom up, sending the concrete down to only one point. In the latter practice only about 10 feet can be poured at once, it then being permitted to set before more is sent down. If much more than this were attempted at a time the forms would not hold, or would be subjected to too great a strain for safety. By putting in bearers each 100 feet concreting can be carried on in many sections at a time, greatly facilitating the operation. The Athens has already been concreted 1,000 feet below surface, or so far as the shaft was carried downward in a circular shape. Below this point the shaft is rectangular and no concreting will be done until it reaches bottom at about 2,400 feet.

REINFORCING BAR BENDING MACHINE

The Waterloo Construction Company of Waterloo, Iowa, has recently placed upon the market the Waterloo reinforcing bar bending machine. It is made in two sizes, and guaranteed to bend bars as follows:

No. 2 bends cold reinforcing bars, including 1⅛ inch round or square.

No. 3 bends cold reinforcing bars, including 1¼ inch round or square.

It is a durable, substantial constructed machine, so arranged to bend reinforcing bars to various angles for all purposes in concrete work. The bending posts are constructed of turned steel. The post revolving through the slot in the plate being equipped with loose steel roller to avoid creeping of bar in bending.

The machines are furnished with a detachable handle seven feet long for convenience in handling. Bars can be bent to a more uniform angle than by any other method and get the maximum strength as designed by the engineer.

Write for circular and prices.

WILL INSTALL NEW KILNS

Aetna Portland Cement Company, Fenton, Mich., has placed an order for two new kilns, 10x175 feet, with Allis-Chalmers Mfg. Co. of Milwaukee. This will increase the output of the plant about 400 barrels more of cement each day.

Concrete Sign and Post Manufactured by National Concrete Sign and Post Co., Oil City, Penna.

EFFECT OF OIL ON CONCRETE.

The subject of the effect of oil on concrete has been taken up by engineers, and they have come to the conclusion that such oil as might drip or be spilled upon the floor would have practically no effect, especially if the oil is not allowed to remain on the floor for any length of time.

Experiments have been made to find out the effect of oil and it is noted that vegetable and animal oils do have a bad effect upon concrete, when it is green, but after it has hardened the effect is not noticeable. Mineral oils and greases have no injurious action. Care must, however, be taken to see that the concrete is dense, otherwise it will be permeable and the oil, especially if it is of a vegetable and animal type, will have a chance to act. If attention is paid to the proper proportioning, mixing and placing of the concrete, we feel confident that you will have no trouble whatsoever from any oil that might come upon such a concrete floor.

In case considerable oil flies over the floor in such a way that the walking of the attendants over it has spread the oil considerably, concrete can be restored to its natural color by use of the following method:

Caustic soda in boiling water applied on the surface liberally and scrubbing with long-handled brooms of strong fibre is the only sure way to remove the grease, but the natural color of the cement will not be restored by such treatment, as the oil has, no doubt, penetrated rather deeply into the pores of the surface. If convenient soak sawdust in the caustic soda solution and place it on the floor about two inches thick, wetting with more of the solution and permitting it to remain over night, then scraping and rinsing the floor with hot water. The operators should wear rubber boots and rubber gloves.

KING'S OFFICIAL AUTO GUIDE.

King's Official Auto Guide is a very complete and up-to-date auto guide for automobile tourists. It not only gives the best roads to follow but mentions the best hotels and supply stations as recommended by Mr. King, who has personally mapped out all routes and inspected the hotels and garages he recommends. King's Auto Guide is so simple a child can follow it. Motorists planning a tour in the country will find this guide a great help in selecting the best roads. This book is published by Sidney J. King, 626 S. Clark St., Chicago.

CONKLIN EQUIPMENT

And **4 men** built these Silos at the rate of 8 feet per day at less cost per foot than by any other method.

GETS THE SILO BUSINESS

because it is a time saver. Molds are interlocking and are independent of construction hoist.

Conklin Equipment builds chutes, continuous or non-continuous doorway, water tanks and concrete roofs.

Write for catalogs and proposition.

Conklin Construction Co., 430 West Main Street HARTFORD, MICH.

HOTEL EMPIRE

Broadway at 63rd Street
NEW YORK CITY

Room, use of Bath $1.00 Room with Bath $1.50

Parlor, bedroom and bath, one or two persons $2.50

Add to the above rates, 50c for each additional person.

All surface cars and Fifth Ave. Busses pass the door.

Subway and "L" stations—two minutes.

Beautiful Central Park—1 block.

OUR RESTAURANT is noted for its excellent food and moderate prices

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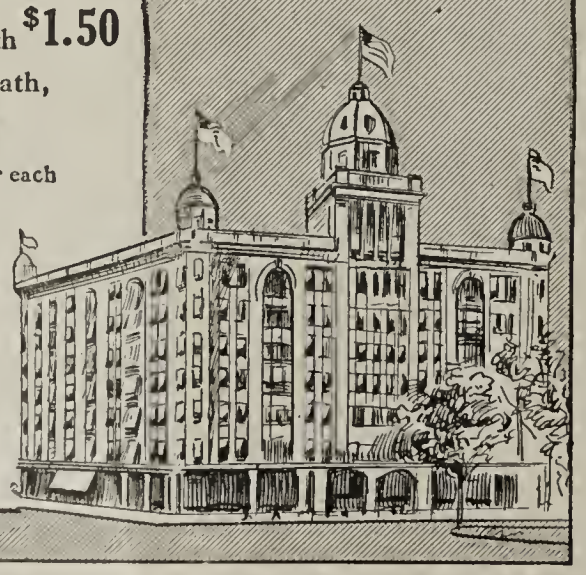

Who Can Use This Machine

Here is a special typewriter offer that will appeal to shrewd buyers. You may choose this Underwood machine, or any other make you prefer, bar none—with complete equipment and latest improvements—and own it without red tape, on the easiest plan you ever heard of, at ½ or ⅛ manufacturers' prices. Write for particulars and see.

This is the time to act—our entire stock is now offered at less than list price. Never before—never again—such bargains. A few cents per day—you'll never miss it—will satisfy us. No other house so liberal—so reliable—so determined to please. Thousands of delighted customers.

But don't confuse **our** proposition with others—don't be fooled. From us only can you get factory-rebuilt typewriters by the genuine "Young Process." Each machine is relentlessly tested when completed, and guaranteed by our iron-bound guarantee that's all in your favor. You can't go wrong. No pay if not as good as new—if it doesn't look and wear just like new—if not clearly the best value EVER PUT UP TO YOU. You take no risk—you can't lose.

Don't waste money. Write for our war prices, special inducements, and book, "The Truth About Typewriters." Don't even think of taking a step until you read this book of inside secrets and see how much better it is to deal with this reliable, old time house. Send no money—just your name and address today—now.

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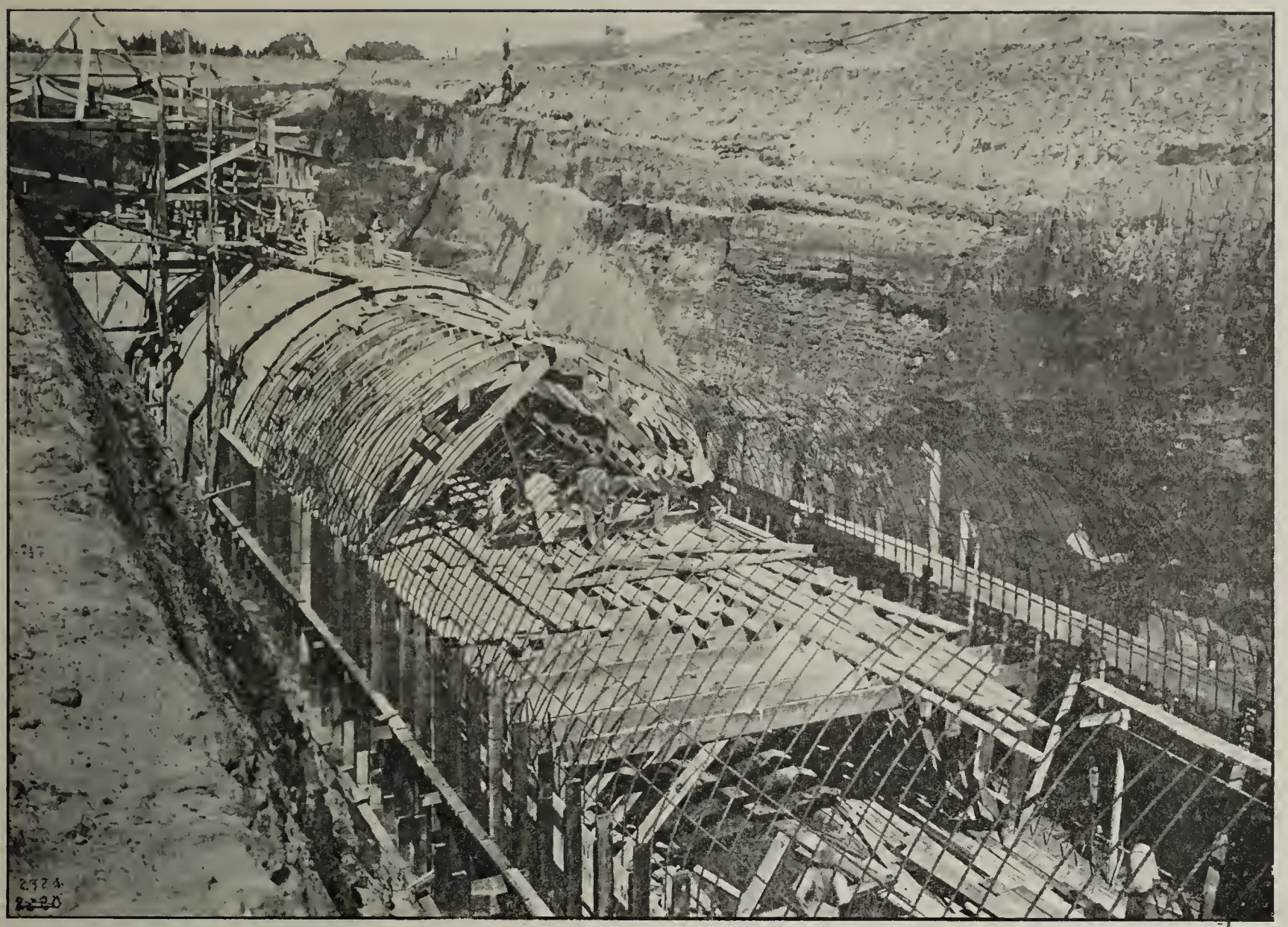

Section near West Portal in open cut.

Concrete Lined Tube, 12000 Feet in Length

The Twin Peaks Tunnel, now under construction by R. C. Storrie & Company for the City of San Francisco, will be a concrete lined tube 12,000 feet in length for double track, rapid transit service. This bore will connect a large residential district in the southwestern portion of the city with the main business section.

The tunnel cost is financed by an assessment levied on the districts surrounding the two portals. The assessment district at the west end contains 4,000 acres, most of which is in large holdings, now subdivided into "restricted" resident tracts. This district was assessed from ½c to 3½c per square foot—depending on the estimated benefit to be derived from the tunnel—for 85 per cent of the total estimated cost of the work and necessary lands for right-of-way. The section about the east portal is well developed and the assessment district therein is relatively small, about 650 acres.

The east portal is located at the westerly end of Market street, the main business thoroughfare of the city. The city purchased a 90-foot right-of-way, extending 1,800 feet from the end of Market street, which, on the completion of the tunnel will be paved as a portion of the Market street extension, and will connect with a boulevard over the Twin Peaks into the residential district at the west portal of the tunnel. This boulevard, now under construction under a separate contract, has a maximum grade of 7 per cent and affords extensive views of all portions of the city and surrounding country.

The approach to the easterly portal is 350 feet long and has a grade of .0424. It consists of a cut 29 feet in width, between two parallel reinforced concrete retaining walls. As the traffic on Market street is growing more congested it will be only a few years until a subway for rapid transit will be necessary under this thoroughfare. In the event of the construction of a subway it will connect with the present construction at the Eureka Valley Station, and the easterly portal of the tunnel and the approach thereto will be used for surface connection.

From the easterly portal the tunnel grade is +.014 for a distance of 600 feet and for the succeeding 1,075 feet the grade is +.0287 and is then +.03 for 6,700 feet, from which section to the west portal, a distance of 3,300 feet, the grade is +.0115.

Types of Tunnel Lining

For the first 1,665 feet, with the exception of 300 feet of the Eureka Valley Station, owing to the slight raise of ground surface and the shallow cover obtainable, a double tube subway type of structure was adopted, consisting of a flat bottom 22 inches thick; side walls 21 inches thick; a 12-inch central wall and a flat slab top 18 inches in thickness. This is of reinforced concrete construction, as are all sections of the tunnel excepting the Eureka Valley Station. The total height inside is 17 feet, and the roof slab is 15 feet above rail, and the width in each section is 14 feet. The reinforcement of the top and bottom slabs consists of ⅞-inch square twisted bars; that of the walls ¾-inch bars, all 9-inch centers. Openings 4 by 6 feet in the central walls and 4 by 6 feet 4 inches by 21 inches deep in the side walls, are spaced 50 feet apart, for the placing of lights and for refuge for trackwalkers.

Beginning 300 feet west of the easterly portal, is the

Eureka Valley Station, an underground structure, consisting of a steel frame on a reinforced concrete footing slab with reinforced concrete walls, roof slab and platforms. This station is 300 feet long and 52 feet 6 inches wide, with a central row of columns and a row of columns along each platform; the platforms being 13 feet 4 inches wide and running the length of the station on both sides. All steel columns and roof girders are imbedded in concrete. At each of the four corners are stairways leading to ornamental entrance kiosks on the surface above.

The roof and sides of this station were waterproofed with a 4-ply felt and tar application, overlaid with a single layer of 3-compartment porous book tiles. The double tube section and all underground sections constructed in open cut were waterproofed along the sides of walls and top with application of an asphalt and distillate compound, applied from a force pump.

The portion of the tunnel proper from the westerly portal to the double tube section, with exception of the Laguna Honda Station, will have three types of lining, depending upon the nature of the ground encountered. These sections of lining differ only in the thickness of the concrete and amount of reinforcing, with the use of invert lining in soft ground.

The inside dimensions of the tunnel lining are 25 feet in width for all sections; 25 feet in height where the invert is lined and 22 feet where there is no invert lining. The height from rail to arch is 20 feet—the net clearance above rail grade being 15 feet, as the upper five feet of the tunnel is cut off by a 6-inch horizontal slab, suspended between the side walls. This slab is supported in the center by 1-inch rods, 10 feet on centers, embedded in the arch concrete and in a longitudinal beam upon the slab.

The arch thickness of the three sections are 22, 18 and 8 inches, respectively, the sidewalls being 2 feet 9 inches at spring line in two sections and 12 inches thick for the lightest section. The heavier section has an 18-inch invert lining. The substitution of a five-ring brick arch lining above the slab in the two heavier sections is optional with the contractor.

The space between the slab and the arch forms a duct through which fresh air from the surface will be forced by two sets of blowers. One set will be at the westerly end of the flat top section, the other in the circular concrete lined shaft from the tunnel to the surface, located 4,600 feet from the west portal. Two-foot square openings, placed every 100 feet in the slab will admit the fresh air into the lower section of the tunnel.

Ten fibre ducts are placed in each side wall of the tunnel and will be used for power and lighting cables. Access to these are had every 400 feet on each side from deep niches similar to those in the double tube section. Between these niches, shallow niches are spaced every 50 feet on each side, as in the other section described, for use as refuge places.

A three-compartment, 6-inch longitudinal porous tile drain is embedded in the outer side of the concrete lining with one face exposed, on each side of the tunnel in the section through soft material. Tees and 4-inch pipe, spaced 25 feet apart, leading into the tunnel will carry the ground water into the track ballast and thence into open joint pipe drains laid in the ballast.

Laguna Honda Station is situated at the peak in the grades of the tunnel at the eastern edge of the residence tracts which are being developed by the tunnel construction. This is a reinforced concrete arch section 300 feet long, having a span of 44 feet. The thickness of arch lining is 3 feet, the invert being 26 inches thick. Stairways on each side and an elevator shaft for three passenger elevators afford access from the surface station to the cars.

Forms

In all open-cut construction, wooden forms were used, those for the double tube section being built in eight-foot lengths in four parts for each tube and used several times.

Within the tunnel the concrete is poured against the timber lining and the inside form, for the side walls and ceiling slab is a two-hinged collapsible form, consisting of $\frac{3}{16}$-inch steel plates bolted to angle iron latticed ribs. The forms are in 10-foot sections with ribs spaced 2 feet on centers and have no cross bracing, thus affording an open passageway beneath. The forms are held in position by a 6 by 6-inch timber stringer across the lower ends of the ribs and slipped over bolts previously embedded in the footing concrete. The forms are kept in place seven days after concrete is poured and are moved and erected from a timber traveller or "jumbo." This jumbo consists of a trussed frame on four legs, which move along rails laid along the footing concrete. Four jacks, one at each corner of the jumbo, engage the forms and the wings are swung in and the forms lowered and moved ahead beneath the other forms and then raised into place. The jumbo is constructed so as to allow passage of muck cars beneath it and thus forms can be moved ahead and set up without interfering with the concreting of adjacent section or the excavation of the tunnel.

The inside footing forms are built of wood in eight-foot sections and after stripping are repaired and used several times. The arch forms consist of 2 by 6-inch timber, set longitudinally on curved steel I beams resting on the ceiling slab. The I beams are 7 inches in depth and spaced 30 inches centers.

Methods of Concreting

The concrete in open cut work, was mixed in standard rotary mixers, set up on the edge of the cuts and was placed with chutes and buggies. The biggest portion was placed direct from chutes without wheeling. Previous to the installation of pneumatic concrete mixers and conveyors a portion of the concrete lining of the tunnel sections was similarly placed.

The pneumatic mixer used consists of a steel cylinder with a cone shaped bottom at the point of which is attached a 90-degree special reducing elbow and connecting with the 8-inch conveying pipe. At the top of the cylindrical portion is a door opening into the cylinder and operated by an air controlled piston. Air feed pipes enter through the side of the cylindrical ring and also into the reducing elbow at the bottom of the mixer. The aggregates and cement are fed into the mixer from a measuring hopper set above it, water is turned on, and the door closed. The air valve is then opened, and the material shot through the elbow into the pipe, being given a rotary motion by two projections running spirally around the inside of the elbow. The concrete is thoroughly mixed when it emerges from the pipe.

Two of these pneumatic mixers are now in use, one near the west portal, the other near the easterly end of the work. Each is set on the ceiling slab in the arch section, at the bottom of short concrete-lined shafts extending to the surface. Above the shafts are constructed the rock and sand bunkers—chutes for carrying cement also pass through the bunkers and shafts. Thus all materials are fed into the measuring hopper by gravity.

The conveying pipe is 8-inch steel pipe with flange joints, bolted together and is laid along the top of the ceiling slab. For filling the footing forms or sidewall and slab forms the pipe is led into a steel receiving hopper at the section to be poured. This hopper is suspended from the arch segments of the timber lining; from the hopper extend chutes into the forms to be filled. This hopper was necessary as "shooting"

the concrete from the pipe directly into the forms displaced the reinforcing steel and conduits.

For concreting the arch, the conveying pipe is led into the forms; as the arch has reinforcing steel only in the intrados, the concrete can be "shot" in without displacing reinforcement. By this pneumatic method, concrete has been mixed, conveyed and placed in forms situated 2,500 feet from the pneumatic mixer on an upgrade of 1.15 per cent. It is expected that concrete will be conveyed by this method over 3,000 feet up the 3 per cent grade from the easterly workings.

The concrete of the footings and the walls and slabs has been done mostly under a regular procedure. The "heel" (the footing of the side walls) was poured in 80 to 100-foot sections and about the third day after, the concreting of the sidewalls and ceiling slab of that section in 30 to 40-foot lengths was begun. During the intervening two days, the footing forms were stripped, the track for the "jumbo" laid and the steel forms were being set. As the walls and slabs were being poured, the setting of the steel forms was finished and excavation and form setting for a section of footing ahead carried on.

The arch was concreted in much longer sections, the pour being continuous through several shifts. A section of the brick arch, 140 feet in length, was constructed at the beginning of underground work near the west portal. When the pneumatic method of concreting was provided for, the contractors abandoned the brick in favor of concrete arch lining.

The lining of the invert, where necessary in section excavated in tunnel, will be placed later, as new outlets for the hauling of the muck to the surface are reached (such as are provided by the open cut at Laguna Honda Station and by the ventilating shaft). The tracks and runways for the disposal of the material in these excavated sections will then be taken up and the invert excavation and lining completed. In the sections excavated in open cut, excepting Laguna Honda Station, the complete linings were placed before proceeding with the tunneling. The invert in the station will be placed as soon as the excavation of the core, now being carried on, is completed.

The concrete mixture consists of 2¼ cubic feet of sand, one-third of which is river sand and the balance bank sand, to each sack of cement, and sufficient rock added so that the mortar completely fills the voids. This varies with the rock used, a river gravel ranging between ½-inch and 2 inches in size, but is usually between 5 and 5½ cubic feet to the sack of cement.

For waterproofing all concrete used in any part of the tunnel section, hydrated lime in proportions of 8 pounds to every 100 pounds of cement, was added before the aggregates were placed in the mixer. Pyramid brand hydrated lime was used on this job, manufactured by International Lime Company, Sumas, Wash.

The concreting of the footings and walls and vent slab follow closely behind the excavation, and at present 3,000 feet of the tunnel at the west end and 2,500 feet at the easterly end are partially lined. Nearly 50,000 cubic yards of concrete have been placed, of which over 10,000 cubic yards were "shot" in place by the pneumatic method. When completed the tunnel sections, stations and portals will aggregate 90,000 cubic yards of concrete, reinforced with 2,500 tons of steel rods.

At the present time the two working faces are 5,200 feet apart, but it is expected that the tunnel will be opened within a year.

The work is being done under the general supervision of M. M. O'Shaughnessy, City Engineer of San Francisco, with L. T. McAfee as resident engineer in direct charge of the construction supervision. R. C. Hackley is in charge of the construction work for the contractor.

COST OF A CONCRETE BUILDING

In a recent address before the Real Estate Exchange of Cincinnati, Mr. W. P. Anderson, president of The Ferro Concrete Construction Co. of that city, gave some interesting figures on the costs of reinforced concrete buildings. While he realized that a good many items included in the cost of such building will naturally vary he takes as a basis a plain structure, with no fancy exterior decorations, and includes the principal items which go to make up the cost, such as, walls, windows, floors, floor finish, stairs, toilets and plumbing fixtures. The cost of excavation, heating, lighting and elevators is so dependent upon each particular building that these items are omitted from the estimate.

The assumed load on the floors is 150 lb. per sq. ft. with column spacing about 18 ft. on centers and story heights about 12 ft. Mr. Anderson estimates the base cost on a building 50 by 50 ft. as about $1.55 per sq. ft. of floor space. If the building is 50 by 100 ft. this price would be reduced to $1.20. If 50 by 150 ft., it would be $1.12, and if 50 by 200 ft. it would be $1.07. In all these cases the building is assumed to be from four to ten stories high. A three-story building would cost somewhat more but the difference would be very slight. A two-story building would cost from 10 to 12 per cent more than these figures, and a one-story building from 15 to 20 per cent more. A decrease in the width of the building would increase the cost so that for a width of 25 ft. instead of 50 ft. the unit cost would be increased from 35 to 45 per cent. If, however, buildings widths are increased the costs would be correspondingly decreased.

The effect of increasing or decreasing the floor load depends on the height of the building. Obviously, there would be practically no change on a one-story building as the load comes directly on the ground. In a six-story building the decrease in cost for a 75-lb. load would be about 12c per square foot of floor space. This figure would also about equal the increase in cost if the live load was doubled.

The effect on the cost of varying the column spacing will not be great. Where columns are spaced about 15 ft. apart the cost will be about 6 per cent greater than where columns are spaced 25 ft. apart both ways.

In giving these estimates of costs for reinforced concrete buildings Mr. Anderson allowed for two stairways and one elevator tower for a building under 150 ft. in length, and two stairways and two elevator towers for greater lengths. Two plumbing fixtures per floor were allowed for the first 5000 sq. ft. and one additional fixture for each additional 5000 sq. ft. No allowance was made for any interior partition work except that which would be necessary around stairs, elevator shafts and toilets. Of course, these estimates are based on plain factory buildings, and any attempt at decoration would naturally increase the cost.

The percentage of window area to wall area would have but little effect on the unit cost of the building. In figuring the estimates given a steel sash window with ordinary glass was used. If wire glass was found necessary the cost would be considerably more than for plain wall.

MILLIONS IN SAND AND GRAVEL

"Sand and Gravel" is the latest chapter from the Mineral Resources report for 1915 available for distribution by the Geological Survey, Department of the Interior. According to this statement the United States produced 76,603,303 short tons of sand and gravel, valued at $23,121,617, during the year.

THE ECONOMICAL BRICK MORTAR

The use of lime in cement mortars is not new; its advantages have stood the test of time; and for years the use of lime with cement was standard practice. Investigation of the construction work of years ago indicates that it was universal practice to specify in all good work a thoroughly aged lime putty mortar gauged with natural cement. Later Portland cement was substituted for the natural cement.

Lime mortars are amply strong for the greater part of brick work. They are much easier to apply and the cost of labor and material is much less.

The old method was to gauge mortar made from lime putty and sand with cement. This was rather an unsatisfactory system because of the difficulty in securing accurate proportions of the cement to the lime and sand used. and in many cases it was claimed that the contractor only "shook a bag of cement at the mortar box now and then." This uncertainty, together with annoyance of preparing the lime on the job is largely responsible for so many specifications being written by architects and engineers for straight cement mortars. With hydrated lime, however, both these objections disappear. It is thoroughly slaked and prepared in a scientific manner before delivery to the work. It comes in sacks containing definite quantities, and there is no difficulty in getting accurate ratios of lime to the cement in the mixing of mortars. and it is easy for the inspector to see that the specific proportions are being used. The use of hydrated lime in cement mortars is merely reverting to a time-tried practice, which has been employed for years, and which, as shown by the work, was entirely satisfactory.

For years it has been known that the addition of a small amount of hydrated lime to cement mortar in brick work results in a more plastic, freer spreading material under the trowel. It has been the custom in many cities to specify a proportion of hydrated lime in cement mortar because it was recognized that it would make work easier.

The mortar being worked more easily under the trowel, permits mechanics to more firmly embed the bricks, and with less physical effort. The bricks will slide freely and the mortar will be forced into crevices where it is impossible to put the trowel. This all results in a bearing surface for each brick which cannot be gained by a hard working mortar.

The practical effect, however, of such mixtures of cement and hydrated lime has always been a debated question and it has remained for Prof. James S. Macgregor, of Columbia University, to arrive at actual facts, and in establishing these facts the question of debate has been removed.

Object of Investigation

Professor Macgregor's investigation was conceived for the following reasons:

1. To indicate what value, from the standpoint of strength, the better bearing surface given to the bricks would possess when laid up with cement-lime mortars of varying proportions.

2. To determine the practical effect on strength when bricks absorb a portion of the moisture from the mortar and thus rob the mortar of the moisture needed to hydrate and harden the cement. This was to indicate whether the water carrying capacity of hydrated lime had a value in retaining moisture in the mortar which would be passed off to the cement and taken up in subsequent hydration, thus resulting in increased strength. The results shown in the "Summary of Ultimate Resistances" proves this reasoning established beyond doubt.

Outline of Investigation

The investigation as outlined consisted in laying up seven different sets of brick piers 8″x8″x84″ high, each set consisting of 9 piers and being laid up in mortar of different proportions, with varying amounts of hydrated lime. Three piers of each set were tested under compression to the point of rupture at three different periods, namely, 7, 28, and 90 days, the results shown being the average of three piers at each period.

The bricks used in the 63 piers were hard-burned face bricks purchased in the open market in New York City. There were also laid up seven piers 8″x8″x84″ of common bricks, each with a different mortar mix, to be tested under compression at the 28-day period, the results of which were to serve as a check on the results shown by the face brick piers. Comparison of ultimate resistances of common brick with face brick, page 29, shows how the general conclusions to be drawn agree and that the same underlying economic and structural value of hydrated lime applies to face and common brick alike.

Description of Mortars

The purpose of the investigation being to determine the effectivenes of hydrated lime, and also to determine to what extent Portland cement might be replaced by hydrated lime without reducing the factor of safety under practical conditions, mortars were mixed containing varying proportions of hydrate. The seven (7) mortars which were used in the investigation were mixed in the following proportions:

Mixtures Used—By Volume

No. 1.	1.00 cu. ft.	Portland Cement.
	3.00 cu. ft.	Sand.
No. 2.	0.90 cu. ft.	Portland Cement.
	0.10 cu. ft.	Hydrated Lime.
	3.00 cu. ft.	Sand.
No. 3.	0.85 cu. ft.	Portland Cement.
	0.15 cu. ft.	Hydrated Lime.
	3.00 cu. ft.	Sand.
No. 4.	0.75 cu. ft.	Portland Cement.
	0.25 cu. ft.	Hydrated Lime.
	3.00 cu. ft.	Sand.
No. 5.	0.50 cu. ft.	Portland Cement.
	0.50 cu. ft.	Hydrated Lime.
	3.00 cu. ft.	Sand.
No. 6.	0.25 cu. ft.	Portland Cement.
	0.75 cu. ft.	Hydrated Lime.
	3.00 cu. ft.	Sand.
No. 7.	1.00 cu. ft.	Hydrated Lime.
	3.00 cu. ft.	Sand.

The proportions given are all by volume, and this method of measuring was followed because it is the general custom in writing building codes to so specify quantities.

Hydrated lime is nearly two and one-half (2½) times as bulky as Portland cement (hydrate weighing approximately 40 pounds per cubic foot, and Portland cement weighing approximately 94 pounds) and the true economic advantage of such volumetric replacements of Portland cement by hydrated lime cannot be fully realized until the quantities shown have been reduced to corresponding weights, the basis upon which Portland cement and hydrated lime are purchased.

On the basis of weight, the mortars previously shown are approximately equivalent to the following:

Mixtures Used—By Weight

No. 1.	100 lbs.	Portland Cement.
	300 lbs.	Sand.

No. 2. 90 lbs. Portland Cement.
4 lbs. Hydrated Lime.
300 lbs. Sand.
No. 3. 85 lbs. Portland Cement.
6 lbs. Hydrated Lime.
300 lbs. Sand.
No. 4. 75 lbs. Portland Cement.
10 lbs. Hydrated Lime.
300 lbs. Sand.
No. 5. 50 lbs. Portland Cement.
20 lbs. Hydrated Lime.
300 lbs. Sand.
No. 6. 25 lbs. Portland Cement.
30 lbs. Hydrated Lime.
300 lbs. Sand.
No. 7. 40 lbs. Hydrated Lime.
300 lbs. Sand.

It will be noticed that the mortar designed as No. 5 contained a total of 70 lbs. of cementing agent with 300 lbs. of sand, or 1 to 4.3 by weight, which may be compared with mortar No. 1 which was composed of 100 lbs. of cementing agent to 300 lbs. of sand, or 1 to 3 by weight.

The economic advantage, the saving in dollars and cents, between mortar No. 1 and mortar No. 5 is therefore measured by the decreased quantity of cementing agent contained in a given volume of mortar, or approximately 30% saving, provided hydrated lime and Portland cement are sold at the same market price per unit of measure.

Summary of Ultimate Resistances

(Face Brick Piers)

Figures shown are in pounds per square inch.
Each result is an average of crushing three piers.

Mortar Mix No.:	1	2	3	4	5	6	7
Crush at:							
7 days	2630	3080	2890	3120	2760	1945	1535
28 days	2840	3170	3230	3470	3100	2370	1870
3 months	2840	4435	4300	4170	3820	2720	1950

It will be noticed that the results, when Mortar No. 5 was used, show a compressive value of 980 lbs. per square inch greater than Mortar No. 1 in 3 months. It has already been noted that Mortar No. 5 contains 30 per cent less of cementing ingredients (or 43% more sand carrying capacity). Herein lies the extraordinary economic advantage, THE GREATER STRENGTH AT LESS EXPENSE.

Assuming the market price of Portland cement and hydrated lime to be the same, pound for pound, it will readily be seen that specifications calling for mortar to be composed of 50 lbs. of Portland cement, 20 lbs. of hydrated lime, and 300 lbs. of sand (approximately ½ cu. ft. Portland cement, ½ cu. ft. hydrated lime and 3 cu. ft. of sand) will not only give a much higher structural value, but will also make a saving of 30 cents on every dollar spent for the cementing mixture in brick mortars.

To insure accurate measurements in practical work, it may be stated that an eight-quart pail holds approximately 10 lbs. of hydrated lime, and for each bag of Portland cement used in making mortar four (4) pailfuls of hydrated lime should be placed in the mixture to secure results equivalent to those produced in the No. 5 test.

The results of this investigation unquestionably determine that hydrated lime has a greater value in brick masonry than it is generally given credit for having.

The great economic advantage to be gained by adopting mortar No. 5 is best shown in the following table, which is based upon the price charged for mortar ingredients in Pittsburgh, Pa., for deliveries in less than carlots. Pittsburgh prices, at the time of writing this article, are: Portland cement, $1.80 per bbl. in paper; hydrated lime, $10.50 per ton in paper; sand, 80 cents per ton.

Mortar Mix—	1	2	3	4	5	6	7
	100 lb. C	90 lb. C 4 lb. hl	85 lb. C 6 lb. hl	75 lb. C 10 lb. hl	50 lb. C 20 lb. hl	25 lb. C 30 lb. hl	 40 lb. hl
	300 lb. S	300 lb. S	300 lb. S	300 lb. S	300 lb. S	300 lb. S	300 lb. S
Crushed at—							
7 days	2630	3080	2890	3120	2760	1945	1535
28 days	2840	3170	3230	3470	3100	2370	1870
3 months	2840	4435	4300	4170	3820	2720	1950
Cost of mortar to lay 1,000 bricks	2.18	2.08	2.03	1.99	1.71	1.48	1.24

Figures taken from the last report of the United States Geological Survey show that during the past three years an average of 8,747,333,000 bricks (face and common) have been sold each year. Assuming that one-half of this output each year had been laid with straight 1-3 cement mortar, then the economic loss, based on the mortar shown in column No. 5, would be $2,055,623 annually, besides having a lower structural value.

REPAIRING AND PATCHING OF CONCRETE

In the August number of Cement and Engineering News I noticed an article on "Methods of Repairing and Patching Concrete." Six different methods were described. I have tried nearly all of these methods, but none of them proved quite so successful, or as satisfactory as the following one:

The surface of the old concrete is thoroughly cleaned and just before applying the new concrete the old surface is thoroughly wetted with a saturated common salt solution. The new concrete may be mixed very wet and held in place with forms, or it may be applied medium wet and thoroughly tamped.

I have used this method for ten years on both large and small jobs and it has produced uniformly good results. One of the first jobs I used it on was a crack in the bottom of a concrete lined swimming pool and another crack in the side wall of the same pool.

The crack in the bottom was over 30 feet long and the one in the side about 8 feet. Both of these cracks were patched by the above method ten years ago and are still perfectly water-tight today.

F. F. Jorgensen, Chief Engineer,
C. & N. W. Ry. Coal Properties,
Gillespie, Ill.

CONCRETE ROAD.

Kenilworth, a North Shore suburb of Chicago, has awarded contract to the Illinois Hydraulic Stone & Construction Co., Elgin, for a reinforced concrete pavement on that part of Sheridan Road running through the village. This section of Sheridan Road has been almost impassable for the last two years, due to the construction of an intercepting sewer under the street. The new pavement will be 40 feet wide, 8 inches thick at the sides, and 10 inches thick in the center and will have an integral curb 6 inches high. The bottom course is to consist of a 1:2½:4 mixture and the top course a 1:1:1½ crushed granite mixture. Triangle Mesh concrete reinforcement will be used, manufactured by American Steel & Wire Company, Chicago. Charles R. Bull is president of the Village Board and C. N. Roberts, Chicago, is city engineer.

Several Illinois and Wisconsin counties and villages through which Sheridan Road passes are making definite plans toward permanent improvement of this famous interstate highway from Milwaukee to Chicago.

CEMENT AND ENGINEERING NEWS

(PUBLISHED MONTHLY)

WILLIAM SEAFERT, Editor and Publisher

Office—672 Transportation Building, Chicago

Telephone, Harrison 5397 Cable Address, "Seaferts" Chicago

Entered at the Post Office at Chicago, as second-class matter, July 21, 1896 under Act of March 3, 1879

SUBSCRIPTION RATES:

United States, Canada, Philippine Islands and Mexico, two years for $1.00; all other countries, $1.00 per year.

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CHICAGO, SEPTEMBER, 1916

THE PORTLAND CEMENT INDUSTRY, JANUARY TO JUNE, 1916

The first half of 1916 has been a busy period for the Portland cement industry in most parts of the United States. Labor troubles have caused the temporary shutting down of a few plants in Illinois, and the business ordinarily taken care of by these plants has gone to others in the central states, but none have been reported as having voluntarily closed in 1916.

The opening of a new cement plant nowadays, when the country is so well dotted with plants, is an event of importance, and the fact that two new ones have begun operations is of considerable interest. Both of them are in the middle west, one at its extreme north, at New Duluth, Minn., the other at its extreme south, at Houston, Tex. The location of both was influenced more largely by commercial considerations than by the proximity of raw materials. The plant at New Duluth, a mill of the Universal Portland Cement Co., utilizes limestone brought by boat from the shore of Lake Huron near Alpena, Mich., and slag from the blast furnaces of the Minnesota Steel Co., at New Duluth. The plant at Houston is mill No. 2 of the Texas Portland Cement Co. It manufactures cement from oyster shells dredged from a reef in Galveston Bay and clay from Harrisburg, Tex. This plant is on tidewater, and efforts will be made to establish for it an export trade with South America.

In 1914 and 1915 there was a decrease in the production of cement, consumers exercising strict enonomy in its use, but the year 1916 shows a reaction, having opened with a demand unprecedented for a midwinter season. Prices, which had averaged only 86 cents a barrel for the entire year 1915, began to rise toward the end of that year and in the eastern and middle states, where cement sold at 70 to 90 cents a barrel, they continued to rise in 1916 until, in June, they ranged from $1.10 to $1.25 a barrel. The increased prices, of course, do not mean an equivalent net increase in returns to the manufacturers, for the costs of explosives for blasting and of coal have both risen, and laborers are in many places demanding an increase in wages. These comparatively high prices have not, however, checked the demand for cement. Many manufacturers are selling all they can produce, and others are even drawing on stocks so as to fill orders promptly.

Although no statistics have been reported to the United States Geological Survey at this date, it is believed that the total output of Portland cement for the first half of 1916 has considerably exceeded that for the corresponding period of 1915. In general an optimistic feeling prevails among manufacturers, and it is confidently predicted that the year will show a gain over 1915, both in production and shipments of Portland cement. Moreover, there is a fair possibility that they will exceed those of 1913 and thus establish a new record.

THE PAPER FAMINE AND HIGH PRICES

The price of paper, which has advanced from 100 to 200 per cent or more, over prices prevailing a year ago, seriously threatens the life of a large number of publications throughout the country and greatly lessens the profit of others.

It is doubtful if any other large industry in the United States has had to face so serious a situation, because when prices of raw materials have advanced the manufacturers of the finished products have advanced their prices and thus thrown the burden on the ultimate consumer. In the newspaper business this has not yet been done. The newspapers, from the largest dailies to the smallest weeklies, have been bearing the burden which to many publications will mean complete destruction and to many others the wiping out of all profit.

Had the newspapers of the country been as prompt to defend their own interests as they have the interests of others, they, too, would before this have undertaken to save themselves by an advance in subscription price and in advertising rates. Under existing conditions they will be forced to do this sooner or later, and they cannot postpone it much longer without serious financial embarrassment to many of them. Hundreds of the smaller weeklies, including the religious papers, which have had but a very narrow margin between loss and profit, will, we fear, suffer most seriously, and many of them disastrously, unless the public promptly recognizes the situation and accepts an advance in subscription and in advertising rates and thus save the situation.

The day laborer, the mechanic, the farmer and nearly all business interests, manufacturing and mercantile, under the activity of the times are showing larger earnings than for years. But the newspapers, as a whole, are meeting a more perplexing problem in the doubling, and in some cases the trebling, of price of paper, and in the absolute inability to contract in advance for supplies, than they have ever had to face before. The statements which have recently appeared in the daily papers on the subject do not at all exaggerate the seriousness of the problem.—[Manufacturers Record.]

CEMENT FLOOR STANDS TEST

Seven years ago the Eastern Avenue Baptist Church began the erection of its magnificent edifice, northeast corner of Eastern avenue and Wealthy street, Grand Rapids, Mich. The east half was built but only the foundation and cement floors for the auditorium of the west half was put in.

Last month the building of the west half was begun. There had been some question whether the cement floor after exposure to the weather for seven years would stand the test. All doubts were dispersed when brick were piled upon it to the extent of 360 pounds to the square foot. To give it further test, steel beams were added. An examination failed to show any effects of the great weight.

The road before and after treatment, La Porte county, Indiana.

Surfacing A Road At One Operation

Special Tractor-Trucks Haul Wagon Trains, Carry Loads, Spread Gravel And Roll Macadam Surface Smooth All At Once

Versatility in contractors' equipment spells economy. The ability to kill two birds with one stone has enabled a Hoosier road builder to construct, with two standard tractor-trucks, a macadam road that would have required seventy-two horses, thirty-six wagons and drivers, and a road roller as well—and it has made it possible for him to do the work in less time and at less cost than by the usual method.

Louis Martine is the possessor of the equipment which made the transformation pictured above at an operating cost of 13½ cents a yard. The motor trucks are of 5 tons capacity, of the tractor type.

The vehicles consist of six-cylinder trucks, similar to the regular four-cylinder 5-tonners except that they have large wheels, back and front, equipped with wide steel tires. It is the ability of these trucks to haul their regular loads over difficult roads, to pull loaded trailers, to dump the material and spread it evenly, and to roll it down, all without pausing, backing or delay—the versatility of the equipment that makes it valuable to the Indiana contractor.

Not only do these trucks fulfill all of the requirements for such work as described below, but they serve equally well as tractors for graders, scarifiers, drags, etc.

Mr. Martine is engaged in $90,000 worth of highway work in La Porte county, Indiana. In addition to using his trucks to pull graders, Mr. Martine takes crushed stone out of freight cars, hauls it 1 mile, dumps, spreads and rolls the stone at a total cost of 13½ cents a yard.

With his two trucks and two trailers, Mr. Martine has handled material which would require 36 teams merely to do the hauling, without spreading or rolling. The saving effected in this work—amounting to the cost of keeping seventy-two horses and hiring thirty-six drivers—was due to the rapid and reliable work of these specially-designed road trucks and to the efficient manner in which the entire work was conducted.

Ten miles northwest of La Porte, between Union Mills and the Scipio township line, a typical farm road 1½ miles long, having a good proportion of clay and often described as having no bottom, was rebuilt with macadam. Instead of closing the road for 6 or 7 weeks, as is customary with old-fashioned equipment, it was kept open continuously.

With the two motor trucks to pull graders and other road machinery, 1½ miles of this narrow, almost impassable, road was widened, graded and leveled in one day. The broad-gauge cambered steel wheels of the good roads trucks, running constantly over the dirt sub-grade, rolled it hard and smooth.

On the second day the laying of crushed stone was commenced. The stone arrived in freight cars on a siding ½ mile from the beginning of the work. One man with a team was employed to move the freight cars into position and four men were hired to feed and operate an automatic stone unloader. From the bins of this unloader, the stone was loaded into the trucks by chutes, this operation requiring but 1 minute for each truck. When the trailers were used, however, there was considerable delay due to a shortage of stone in the loaders.

Four other men were employed on the road—a foreman, a man with team and leveler, and two rakers.

Beginning at the point nearest to the unloaders, the truck hauled and spread 5 yards each trip. The tailgate of the truck is designed so that the opening can be limited to any desirable width and it is built with a

How the tractor truck spreads its load evenly over the road surface.

tripping device operated by the driver from his seat. With the body elevated by the power of the motor and the tail-gate set for spreading, the driver starts the truck forward and trips the tail-gate, allowing the stone to fall in a layer of uniform depth and width. The amount of raking to be done is insignificant.

The road was built 10 feet wide with 10 inches of coarse stone and two inches of screenings. As each new load was brought to the job, the trucks drove over the load that was previously spread and the constant running on this stone compacted it so thoroughly that no other rolling was required before laying the top dressing. In the same manner the top dressing was compacted and bound. When the two motor trucks had completed 11 hours' work, ½ mile of this road was finished macadam.

2 truck drivers at $3.50 per day	$7.00		
Gasoline	4.75		
Oil	1.12		
264 yards hauled, dumped and spread		12.87	
Cost of hauling, dumping and spreading 1 yard			.0487
1 man with team and leveler	$2.25		
1 foreman	3.00		
2 rakers	5.00		
264 yards worked at cost of		10.25	
Cost of working, per yard			.0389
Total cost of unloading, hauling, dumping, spreading, leveling, raking and rolling.		$35.86	
Total cost per yard			$.135

How the road is rolled, dispensing with a steam roller. Left, the truck preserves the crown of the road because of the shape of its tires. Right, all loads are carried over the complete road, the vehicles running in different tracks.

On the third day two 3-yard trailers were attached to one of the trucks, making the capacity of the train 11 yards. The truck and trailers were loaded in a little over 2 minutes. Having completed ½ mile of the road the second day, the length of the haul was increased to a minimum of 1 mile, all of which was up grade. The ½ mile from the loaders to McLane road was sandy in some places and muddy in others—so soft that snatch teams would be needed—but the wide wheels of the motor trucks soon ironed and hardened the surface. Under favorable conditions the truck and trailers with a total load of 14 tons, made this 1-mile pull, dumped and spread its own load, pulled the trailers into position to dump and returned to the loaders, all in 30 minutes.

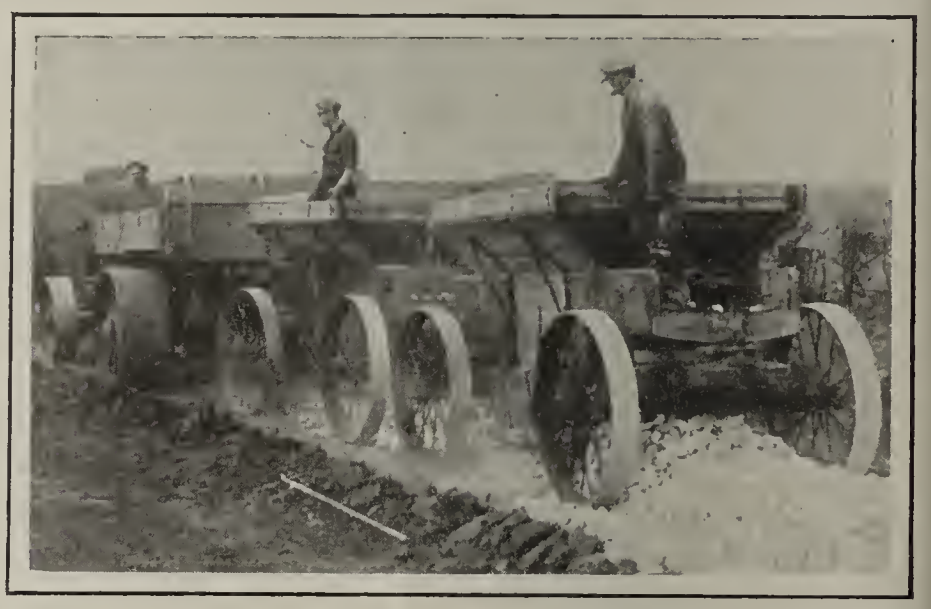
Two Trucks = Thirty-six Teams

Mr. Martine said it was impossible for a team to haul more than 1¼ yards of stone under the same conditions and that a team could make only one trip in an hour. It would therefore require thirty-six teams merely to haul the same amount of material which the two motor trucks and trailers hauled, dumped, spread and rolled.

Mr. Martine keeps careful records of the work done by his trucks and the cost of operating them. Following is a statement covering the operating cost of moving 264 yards of stone in one day by two motor trucks, the trailers being used only at intervals:

Budd Steel Gondola on Curtis Publishing Co.'s C. T. 5-tonner

1 man and team to move freight cars	$2.32		
3 men feeding stone into unloader	7.42½		
1 man to operate automatic unloader	3.00		
264 yards unloaded at a cost of		$12.74	
Cost of unloading, per yard			$.0482



Dumping the trailers, the tractor having dumped its load beforehand.

CEMENT MILL IN GUATEMALA

Gustave Novella, an Italian engineer engaged in the construction of the Pan-American Railroad, was a visitor in Chicago recently. Mr. Novella, accompanied by his wife, has come to the United States to purchase material for the extension of the work, which had been temporarily interrupted for lack of construction concrete. The railroad will connect the republics of Salvador, Honduras, Guatemala and Mexico. The Mexican section has already been completed. Mr. Novella says the people of Guatemala are now manufacturing their own building materials. A cement plant has just been built, and its output is expected to aid considerably in completing the construction work of the road. Mr. Novella will leave for New York at once.

CONCRETING

By W. J. Potter

Successful concreting may be divided roughly into two main parts, the proper combination of elements making the whole and the proper handling of this mixture to best carry out the purpose intended. These main heads are divided into many sub-divisions, each of which like the parts of a machine, have definite importance in the perfection of the whole. While as in a machine, a poor part may do the work intended, yet it will not do as much work or of the same quality as a perfect part. So, in concrete working, an operation may do the work intended, but the whole will not be as perfect as it might if this component part or operation does not harmonize with the general tone of the work. Thus no matter how perfectly materials have been mixed, the properties thereby gained may be lost in placing, if, for instance, the materials are dropped for a considerable distance, or again, if after being deposited, they are not worked or puddled.

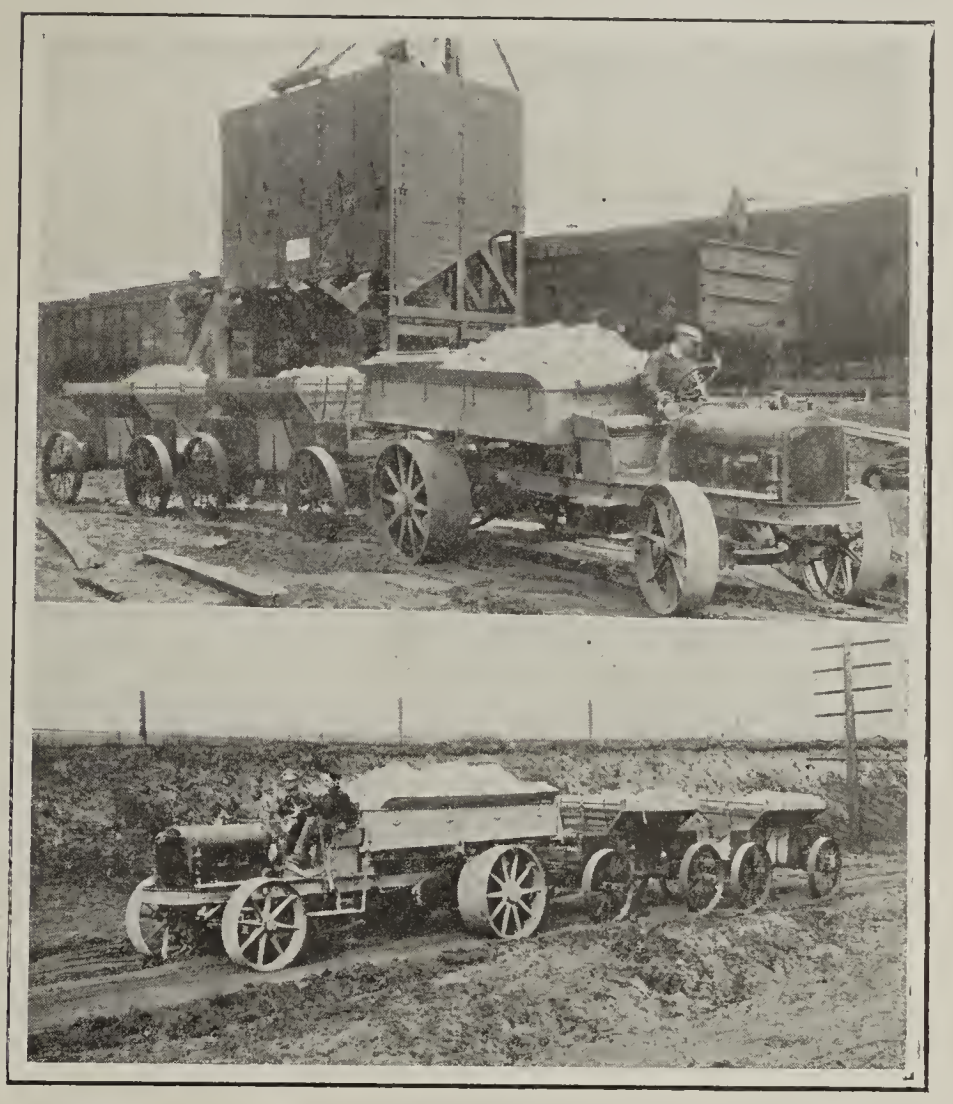
Taking up the first question, that of mixing, we have the most important phase, the determination of proper proportion. Engineers differ as to the proper method of measuring material. Some men favor quantity measure, advancing the theory that what is lost in actual quantity is made up in time saved. Machine measurers are arranged on this principle. Just at present, the mechanical weight measurers have not been perfected sufficiently to admit of practical value upon small jobs. Taylor & Thompson assert the supremacy of measure by weight, advancing economy of material as supporting their argument.

The next point in importance is the consistency of the mixture. This is brought about only by the most thorough mixing. The consistency giving best results in reinforced concrete is such that the mass will move slowly in and around all obstructions. In ordinary mass, concrete should be jellylike, so that it quakes readily when being worked. Concrete congealing before its being placed and worked indicates that the cement is too rapid and mass must be hardened under water. Dry concrete well mixed and tamped is available at shorter notice and stands severer tests; but the danger lies in the dry pockets, which weaken the mass, admit water, and later show in form of pocks, when near a surface subject to hard usage. Occasionally, where a too wet mixture is used, the light ingredients do not flow around the stone and when boarding is removed, the mass has a honeycombed appearance, with the further disadvantage of crumbling unless patched.

Cement is the binding agent in concrete; neither the stone nor sand is of value till bound by some adhesive agent. Mixing by hand, the sand and cement should be mixed first, both ingredients being dry and then applied to the granolithic grit. There are several rule-of-thumb methods concerning the period at which water is to be applied and the best method is a matter of opinion. In my own case, I believe in well mixing the sand and cement and then adding water, and finally the stone. The oftener the mass is turned, the better the lighter ingredients will move about and attach themselves to the heavier. The idea is to have the binding force so disseminated throughout the mass that each particle of cement will exert its influence upon a foreign substance, and hence gain the maximum binding efficiency. This highest effectiveness is gained before the water or stone has been added to the mass. Sand and cement will affiliate better when dry. They will take the water better when together and insure more perfect plasticity without dry powdery cement spots.

The relative importance of machine versus hand mixing is a question largely determined by circumstances. Where it is a question of small jobs with time as an influencing factor, the old hand method is better. Labor is cheap, the plant (an iron sheet) inexpensive, and transportation a minor factor. However, on large jobs, where the material is heavy, the need of accuracy imperative, the mixing and measuring by machine is far superior to hand work. It produces better concrete, is more economical and pays for itself in wages and time saved.

In distributing, the chief object is to produce a mass of uniform consistency. Dump cars on rails, in carrying on large operations, are of great economy, permitting rapid and thorough working where the distance from dump car to forms is not very great. A fall of five feet will disarrange the particles of mixed concrete, and will force stones to the bottom without their having sufficient adhesive element to bind properly, besides expending more material than necessary or practical. Only very wet concrete can stand much of a drop without disarrangement and even then the results do not justify such a method. A trough running from the dmp cars to the form will distribute material evenly and gently without disturbing the relative consistency of the mass, and without destroying any of the advantages gained by thorough mixing of the component parts. Ordinary concrete will run on an incline of one in seven, or even one in nine. In placing the concrete it should not be laid deeper than ten inches without ramming. Of course this thickness varies according to the consistency of the material, and the degree of wetness. The method of scattering and working the mixture in thin layers as soon as it is placed in forms, is more advantageous than placing a great depth before working, or delaying the working of material until it has started to stiffen.



Loading 3-yard trailers, two of which, with the 5 yards in the truck, enable 11 tons to be taken per trip.

The portable stone unloader shown above for unloading cars is made by the Galion Iron Works & Mfg. Co., 124 East Main street, Galion, Ohio.

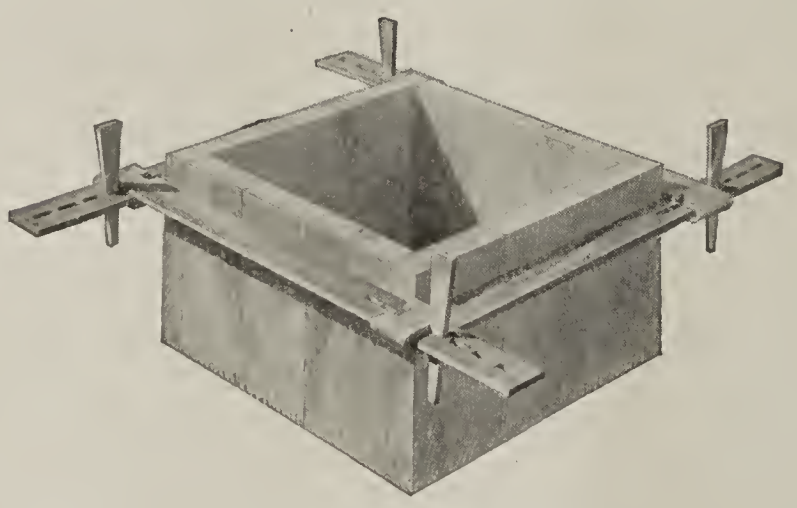
Making 4 miles per hour with 11 yards, showing how the wide, roller-like wheels smooth out the ruts.

The thoroughness with which the material has been tamped or settled has the greatest influence on the ultimate strength and appearance of the finished product. When the concrete has been sent with a rush into the forms, like any liquid or glutinous mass, it takes air particles with it, and because of its nature the air bubbles which are formed do not come readily to the surface. The mixture must be worked over and settled. These small air bubbles in the puddling combine on contact and when sufficiently large, rise to the surface and liberate the air. Air has great elasticity and when compressed is capable of keeping the lighter materials of concrete at bay till the hardening of the latter leaves an air cell, which is a defect leading to greater defects. I have found it of great advantage to work over the materials when laid, with a garden fork or spade. Care must be exercised when puddling not to exert a force too great for the containing forms. A yield in the latter leaves an ugly bulge which is not alone unsightly in itself, but spoils the appearance of a large stretch of the work. Foot tamping with a spade, to allow cement to ooze outside of the rock center and form a smooth facing surface, is liable to strain the forms likewise. Light material in making the latter, or loose carpentry in their construction affect the looks of the finished whole and gives it the appearance of bungling.

The chief object of ramming a dry mixture is to compel uuiform distribution of the cement under and around the rock particles. In tamping the very wet mixture blows are light, just strong enough to force out the imprisoned air. In this operation we have the finishing touches to the job. There are many types of tamping irons, answering the same purpose, their use being a matter of opinion. No hard and fast rules can be laid down in finishing off the job. Local conditions vary and affect the work. Best results are gained by the observation of all established rules, and where conditions are unprecedented, then by the application of the engineer's ingenuity.

ADJUSTABLE CLAMP FOR CONCRETE FORMS

A simple and practical clamp for concrete forms has been invented and patented by the K. & W. Clamp Company, Builders Exchange, Minneapolis, Minn. Advantages claimed for the device is that it is the most perfect adjustable clamp made, will fit any size column, can be employed for forming octagonal or



The K. & W. Clamps

rectangle columns as well as square columns and combines simplicity, durability and efficiency.

K. & W. clamps have no "dead space." Have no slides to clog up with cement. Easier to handle, store and ship. Will last longer and will pay for themselves on the first job. Require but one tool—a hammer.

Don't waste time fixing forms by old-fashion methods—cut out the expense of cutting and threading bolts.

MEDUSA WATERPROOFED WHITE PORTLAND CEMENT FOR STUCCO AND CONCRETE BLOCKS

Medusa Waterproofed White Portland Cement is the most reliable inexpensive waterproofed cement manufactured, and makes mortar or concrete absolutely waterproof, preventing the slightest penetration of moisture or dampness. It prevents discoloration of concrete blocks or stucco after heavy rains, and does not affect strength, setting or hardening qualities of concrete.

Medusa Waterproofed White Portland Cement consists of Medusa Waterproofing ground with White Portland Cement in the process of manufacture. This insures a thorough mixture in exactly the right proportions.

This cement is to be used in the same manner as ordinary Portland, from which it differs in no respect except in its pure white color.

Medusa Waterproofed White Portland Cement is used in stucco or exterior plaster as it prevents efflorescence and hair-cracks, and also prevents the corrosion of metal lath which is likely to occur if the cement plaster allows moisture to penetrate.

Concrete blocks are now being used in the construction of a great variety of buildings, in many of which waterproofing is absolutely necessary. Concrete blocks faced with Medusa Waterproofed White Portland Cement will be absolutely water- and moisture-proof and permit plastering directly on the blocks, thus saving the expense of furring and lathing.

Write the Sandusky Cement Company, Engineers Bldg., Cleveland, O., and ask for their new booklet T-4.

JEFFREY MANUFACTURING COMPANY OPENS NEW BRANCH OFFICES AT DALLAS AND ST. LOUIS

The Dallas office of the company will be located in the Commonwealth National Bank building, and will be in charge of Mr. J. U. Jones. With twenty years of successful salesmanship to his credit, and a thorough personal knowledge of the state of Texas and the requirements of its buyers, Mr. Jones is especially well equipped to take care of the constantly increasing demand for Jeffrey products in his vicinity, and render valuable assistance to clients in solving their elevating, conveying and transmission problems.

Mr. W. V. Cullen has been placed in charge of the St. Louis office, with headquarters in Room A-21 of the Railway Exchange building, which office has been opened in order to supply the many requests from manufacturers in and about St. Louis for advisory service in connection with their conveying and power handling problems. Long experience in sales engineering work, and training in the application of Jeffrey products especially qualify Mr. Cullen for handling this work, and he will appreciate the opportunity of serving any who may be in need of his assistance.

ENLARGING LINK-BELT FOUNDRY

The Link-Belt Company of Chicago announce that they are enlarging their malleable foundry at Indianapolis in order to meet the increased demand for Link-Belt. The foundry extension will be a one-story building, 70 feet by 275 feet with a wing 106 feet by 140 feet. It will house their fifth melting furnace and will provide space for sixty molders. Contracts have all been let.

CONCRETE SIGN POST

The National Concrete Sign Post Company, Oil City, Pa., recently incorporated with capital stock of $30,000 to manufacture signs, posts, pipes and similar reinforced concrete products.

New Plant of the Texas Portland Cement Company at Houston

The extensive shell deposits found all along the Gulf Coast have for many years been the object of considerable research work by Portland cement manufacturers as the shells properly prepared represent the purest lime constituent possible for cement making.

In the past, however, the difficulty has been to find a process by which the shells could be pulverized preparatory to mixing them with the alumina and silica constituents as contained in certain clay deposits but this problem has at last been solved by treating the shells under the wet process as developed by F. L. Smidth & Company, Portland Cement Engineers of New York City.

The new plant which the Texas Portland Cement Company has completed at Manchester, near Harrisburg, Texas, is the result of the research work conducted in the company's laboratories at Dallas, Texas, as well as the recheck in the laboratories of F. L. Smidth & Company, who have offices and laboratories in New York City as well as all the principal cities in Europe and the plant as completed is beyond question of doubt the most modern and unique cement plant in the United States, if not in the world.

The most modern and unique cement plant in the United States. Will manufacture cement out of oyster shells. Their location will enable them to serve the South American market to better advantage than any other plant now in operation in the United States.

The location of the plant was selected at Houston, Texas in preference to other shipping points along the Gulf Coast on account of the railroad facilities available at Houston and particularly on account of the recently completed ship channel which will enable the Texas company to handle export shipments by loading the cement direct from the plant into the bottoms.

The actual construction work of the plant was started in the late fall of 1915, at which time the company's engineering force was moved from the main office at Dallas to Houston, while the plans and contracts were prepared in the office of the company's consulting engineer, Mr. H. Struckmann, at Kansas City.

The plant represents an investment of approximately $750,000 and as can be seen from the general view the various structures occupy considerable space, the plant described briefly consisting of the following buildings and structures.

On the ship channel is a wharf of ample capacity to receive the shell barges; bulk-heads having been provided along the short to prevent any sliding or caveins of the bank which might gradually fill up the channel. From the wharf a 650 foot long structural steel crane runway supports an electrically operated monorail crane which serves the double purpose of unloading the shells from the barges and delivering them to the mill, as well as delivering the shells from the barges to a storage underneath the runway which will take care of about 20,000 cubic yards of shells, this latter precaution being necessary to insure steady operation in the plant whenever weather conditions interfere with the dredging process in Galveston Bay.

Next adjoining the crane structure is seen the wet raw grinding department used in treating the shells and clays which are ground preliminarily in a No. 85 wet Kominuter and finished in a No. 20 tube mill, discharging the resulting finely pulverized slurry into two basins which are being agitated constantly and from these basins the chemist gets his first check on the analysis of the raw material before the pumps discharge the finished slurry into a series of storage basins which makes it possible to secure a perfect and uniform mix of the raw material before delivering same to the kiln for burning.

This feature in the wet process as used at the Houston plant is one of the important points which has made it practical to produce a high grade and uniform cement out of a material which in the past has had little or no value and which now will enable the Texas Portland Cement Company to serve the South American trade as well as the city of Houston and territory adjacent thereto.

After the finished slurry has been analyzed, corrected and checked, it is delivered to the kiln department ready for the burning process which takes place in a 9x8x220 foot rotary kiln operated by variable speed motors so as to give the chemist perfect control over the burning; residuum oil being used for fuel.

From the kiln, the clinkers are discharged into a 6x60 foot rotary cooler where they are cooled preparatory to adding the usual amount of sulphuric anhydride which is mixed with the clinker in the form of gypsum.

The last stage in the manufacture of the cement, the clinker grinding, is handled with one No. 85 Kominuter and one No. 20 special Danula tube mill, which represents the latest improvement in tube mill grinding and which has shown a very remarkable saving in horsepower as compared with past known methods of tube mill grinding. The Kominuter and tube mills were furnished by F. L. Smidth & Company.

The product discharged from the clinker mill is delivered to a belt conveyor discharging into the warehouse which consists of four 30 foot diameter by 60 foot high circular concrete tanks nested together using the ends and inter-space for storage in addition to the main tanks.

The packing department, screen house and train shed are built monolithic with the circular silos which are elevated about four feet above the outside ground level

so as to permit plenty of air and ventilation in the basement which contains the conveying machinery.

The power plant consists of a monolithic concrete structure large enough to accommodate four 450 K. W. Deisel engine units, direct connected to electric generators. Only two of the engines have been installed for the present capacity but all arrangements have been made to install two additional units.

In general the plant has been equipped with the most modern and up-to-date machinery on the market and the fact that the wet process has made it possible to treat the material available and produce a high grade Portland cement out of same, incidentally eliminating the usual dust nuisance surrounding a cement plant surely is very gratifying. The Modern Packer, furnished by the Modern Bag Company, East Orange, N. J., is installed in this mill. Each sack is weighed absolutely correct.

While the plant has now been in successful operation for nearly two months during which time it has turned out close to 50,000 barrels of cement, the company has just recently started shipments under the direct supervision and recheck of the engineers of the Pittsburgh Testing Laboratory, who certifies to the quality of every barrel of cement leaving the plant.

In this connection one of the important features of the plant is that by using oil for fuel and shipping kaolin in from the numerous deposits in Texas, it will be possible to produce pure white cement out of the materials used at Houston.

The completion of the plant in slightly over six months establishes beyond question of doubt a record for speed in Portland cement plant construction and the permanent nature of all the structures speak well for the Texas Portland Cement Company's confidence in the City of Houston as well as the Houston ship channel on which the plant is located.

PERSONAL REMINISCENCES OF J. M. DODGE

In these personal reminiscences Mr. Piez, president of the Link-Belt Co., tells of the struggles, early failures and final great successes of one of the most commanding figures in American invention and engineering, and shows us the genial, charming personality of one who did much to shape our present-day industrial ideals. The first part deals with the development of the conveying and coal-storage business and covers a period of Mr. Dodge's life down to about 1900.

In the second part the author reveals the lasting influence of Mr. Dodge in softening and humanizing the Taylor system of management at the time it was installed in the Philadelphia plant of the Link-Belt Company. A number of important inventions in the conveyor and power-transmission field were also brought out after 1900. But important as all these achievements are, his friends will remember Mr. Dodge longest for his magnetic personality, quick sympathy, and never-hesitating helpfulness.

CEMENT MILL EMPLOYES GRANTED VACATION

The 200 employes of the Burt Portland cement plant at Bellevue, Mich., have been granted a vacation, on full pay, to last as long as the extreme hot weather continues. This is a radical departure in the treatment of its men by a large employing concern, the idea originating with George R. Burt of Battle Creek, head of the firm. Frank McClintic, one of the directors, states: "The act is purely for humanitarian reasons. The conditions about the factory are extremely unpleasant just now, the heat being so intense that in a short time the men if kept at work without a rest would be unlikely to continue as bread-winners for their families." The men are required to "ring in" at the factory at the regular time each day, so that when the weather becomes bearable they will be ready to resume their duties without delay." The men are requested to do nothing but rest. Only two of the departments are kept running, the sales and the shipping. Mr. Burt has done much during the past year to better the working conditions of the employes. He has installed a number of shower baths at the factory and several more are now being installed.

CHOCTAW CEMENT MILL FINISHED

F. W. Freeborn, president of the Choctaw Portland Cement Co., Hartshorne, Okla., announces that the plant of the company has reached completion and will be ready for business in a very few days. The quarries, kilns and grinding apparatus have all been installed and final inspection has shown that every detail is satisfactory. Work upon the construction of this plant was started about five years ago but the company became discouraged when the mill was about half completed and reorganized.

IMPORTS AND EXPORTS OF CEMENT DURING JUNE, 1916

Imports

Districts.	100 lbs.	Dollars.
Maine and New Hampshire	32	23
Dakota	15	12
Total	47	35

Domestic Exports

Countries.	Barrels.	Dollars.
Bermuda	360	593
Canada	1,209	1,849
Costa Rice	986	1,989
Guatemala	460	777
Honduras	824	1,601
Nicaragua	360	628
Panama	77,029	117,591
Salvador	3,110	5,293
Mexico	2,663	6,191
Newfoundland	1,004	1,279
Jamaica	2,750	5,463
Trinidad	1,900	2,773
Other British West Indies	2,715	4,235
Cuba	56,271	86,037
Dutch West Indies	3,250	5,089
French West Indies	915	1,433
Haiti	2,956	4,335
Dominican Republic	3,630	5,519
Argentina	500	735
Bolivia	850	1,292
Brazil	34,114	47,526
Chile	7,080	10,388
Colombia	4,090	6,533
Ecuador	770	1,203
British Guiana	2,800	4,244
Dutch Guiana	2,000	3,188
French Guiana	300	440
Peru	6,367	13,693
Venezuela	6,108	8,871
British India	20	75
Straits Settlements	2	3
Dutch East Indies	135	405
French Oceania	160	301
Philippine Islands	7	10
British West Africa	2,425	3,592
British East Africa	60	90
Portuguese Africa	80	148
Total	230,260	355,412

THE MANUFACTURE OF SAND CEMENT ON THE RIO GRANDE PROJECT

By Rapier R. Coghlan, Manufacturing Cement Chemist, United States Reclamation Service

A plant for producing sand cement is similar in detail to the raw-grinding department of a Portland cement plant. In the former the product obtained from the milling operations is ready for immediate use in making concrete. The raw-grinding department of a Portland cement plant merely prepares the mixture of calcareous and argillaceous material for burning to clinker in the kilns, after which the clinker must be finely ground and mixed with a small amount of gypsum or plaster of Paris to control its setting qualities, when it is ready for use in concrete.

Portland cement is a chemical compound of more or less definite composition, which undergoes decomposition in contact with water, bringing about the formation of new compounds which have the properties of setting and hardening necessary to hold mixtures of sand and rock in a definite form for an indefinite period. Sand cement is a definite mechanical mixture of a siliceous material and Portland cement, which, on the addition of water, develops definite chemical properties but little, if any, inferior to those of Portland cement when used in mass concrete.

As indicated above, sand cement is composed of two materials—Portland cement, which may be purchased from the manufacturer, and a siliceous material which is generally of easy access in all but limestone countries. Its manufacture involves no chemical reactions; all that is required is the reduction of the siliceous material to a size small enough to accurately mix it with the Portland cement, which is already of extreme fineness. After the two materials are proportioned they are ground together to an impalpable powder, much smaller in grain than the Portland cement itself.

The sand-cement plant at Elephant Butte included in its equipment a crusher and rotary dryer which prepared the siliceous material—in this instance sandstone—for its preliminary pulverizing. The pulverizing was done in a ball mill by means of a charge of 4,500 pounds of steel balls dropping on offset plates as the mill revolved. The pulverized material of sufficient fineness worked through screens by gravity and centrifugal force, and dropping onto a conveyor was elevated to a storage bin adjoining a similar bin in which the Portland cement unloaded from cars was stored. Beneath this double bin was a revolving mixing machine, which allowed the pulverized sandstone and Portland cement to be blended in any desired proportions. The blended material was then elevated to hopper tanks, which discharged it into tube mills. The tube mills, four in number, were steel cylinders 5 feet in diameter and 22 feet in length. They revolved 23.5 times a minute. Loaded to half the diameter with flint pebbles, they quickly reduced the blended materials to an impalpable powder which was mixed with extreme intimacy. The material discharged from the tube mills was sand cement, which was stored in bins and used in the same manner as Portland cement. The process of manufacture was under constant chemical control, and the product obtained was very constant in composition and quality.

The use of flint pebbles in the tube mills has been mentioned. The outbreak of the European war cut off the supply of these pebbles. Canadian pebbles were purchased, with decreased efficiency, and in the latter days of the operation basalt pebbles were used, but proved very unsatisfactory on account of the ease with which they broke. The material was very homogeneous but not of the right quality to make good grinding surfaces.

The sand-cement plant at Elephane Butte cost $70,550 and manufactured 621,500 barrels of sand cement, with an average composition of 52 per cent of Portland cement to 48 per cent of sandstone. The net saving from the use of sand cement at Elephant Butte was approximately $250,000.

WATERPROOFING STUCCO

One of the greatest objections to concrete and stucco as building materials, has been the fact that it was difficult to render the surface absolutely waterproof. By using the greatest care and skill in proportioning and mixing, as well as carefully selected materials, it was sometimes possible to obtain an approximately impervious mixture, but, as a rule, the dampness would show through the wall after a heavy rain.

With the intention of furnishing contractors with a material for use in these cases, the Standard Paint Co., 572 Woolworth Bldg., New York, N. Y., have prepared "Impervite." This is an asphalted paste, which mixes readily with the water used in mixing sand and cement, and, when used according to directions, it gives a surface through which no water or dampness can penetrate.

The Standard Paint Co. has prepared specifications for the use of Impervite in stucco, whether on terra-cotta, concrete blocks, brick, or lath, as well as numerous suggestions and directions for its application under practically all circumstances and conditions. These specifications, as well as the other information, will be sent free to those who are interested in stucco or concrete construction.

HELP WITH SIDEWALK WORK

There has been considerable advance in the methods of laying concrete sidewalks. The fallacy of a cinder or gravel foundation has been clearly shown by much experimental work. The practice of excavating for the sidewalk five or six inches below the sub-base level and back-filling with cinders or gravel is still followed to some extent. However, this porous sub-base only furnishes a channel for the accumulation of moisture, which in turn, if not properly drained, will freeze during the winter and heave the sidewalk. Of course, sub-base soil conditions govern foundation preparation, but in ordinarily firm clay soil the elimination of a porous foundation is an advantage rather than a disadvantage, and of course reduces construction costs.

Further economies in sidewalk construction are obtained by using a one-course construction instead of the common method of laying a weak base and surfacing with a rich mortar. The one-course type is more economical in materials and labor and by a properly organized gang considerably greater yardage can be laid in a day than where the two-course type is used. A considerable quantity of sidewalk has been laid using a 1:2:4 mixture with properly graded aggregates of one course throughout, with expansion joints such as are customarily provided, and the results have proven the economies and durability of this type of construction.

CEMETERY FENCE.

A substantial concrete fence was recently built around the cemetery at Liberty, Mo., by B. F. Hayes, a contractor of that town.

The fence was desired as a substantial enclosure rather than as an ornamental feature, and so was built with heavy, solid panels.

Hydraulic Sand and Gravel Mining

By R. J. Borhek, C. E., Tacoma, Wash.

Costs of hydraulic sand and gravel mining are extremely variable. The geological and physical characteristics of the deposit, source of water supply and output determine the ultimate cost.

A glacial deposit well balanced in sand and gravel, freedom from clay or cementing materials; bank of sufficient height, little overburden, low lift for water and proper inclination of flumes will assure a low cost of handling. Should the deposit contain an excess of oversize, much foreign matter and a restricted height of bank, then the cost of product will naturally be higher. This may be reduced by proper methods of handling oversize and economic method of washing and screening. Should the bank be too low for economic sluicing, this difficulty may be overcome by stepping down, provided the material is of such character to be reclaimed. This will mean an additional cost of 3 cents to 5 cents per cubic yard.

The amount of water to be used is dependent upon the character of the material, size and cleanliness, and the inclination of the flumes, which may vary from 6% to 15% for economic reclamation.

For any given quantity of water, grade of flume and material of similar character and disposition, the maximum output of any bank is dependent upon the proper mixture admitted to the flumes. Flume transportation of sand and gravel are vastly dissimilar in character and must be treated as such. In the one case, for a given inclination of flume it would require six volumes of water to one of sand, against five volumes of water to one of gravel. Sand and gravel mixed in the proper proportion would require four volumes of water to one of solids, and in some instances, even less water for economic reclamation of the bank material.

For economic operation the proper mixture should be admitted to the flumes, sufficient working faces and sufficient laterals and pipe outlets should at all times be available.

Source and cost of power for pumping are all factors in the ultimate cost and can only be fixed dependent upon local conditions. Washing and screening costs are fixed for any given material and vary only according to the disposition of the means at hand and character of the material.

Deposits containing from 20 to 25% waste material have been handled at a cost of 15 cents per cubic yard, where the conditions were favorable for the disposal of the waste and crushing of oversize not warranted.

An instance is recorded where 150 feet of clay had to be penetrated by a tunnel before the gravel and sand could be reached: the material handled at a cost of 12 cents per cubic yard, with an output of 700 cubic yards per day. Another instance of flume transportation of one-quarter mile, where the output, screened and washed in bunkers cost 13 cents per cubic yard.

Probably no where in the country has the sand and gravel industry been more widely studied or a diversity of means employed or such strides made in the economic reclamation of sand and gravel, correct washing, sizing and grading than on the Pacific Coast.

Hydraulic and mechanically operated plants. Steam, electric, gas-driven piston pumps, centrifugal and power pumps, steam shovels, drag line, cableway, power scraper, and scraper buckets operated with and without tower, belt and bucket conveyors, steam and electric hoists, mechanical and hydraulic screening and washing plants, crushers and crushing rolls, sand separators, washers and dryers; most every conceivable means of reclaiming the material dependent upon the supply and economy of operation.

Hydraulic plants having capacities ranging from 300 to 2,500 cubic yards per day are operated at costs of 15 cents down to 8 cents per cubic yard, including all labor, material, power, renewals, depreciation, interest, taxes and fixed charges of every kind incidental to placing the material in bunkers washed and sized ready for marketing.

The economy of this method is at once apparent when we take into consideration the little machinery employed and the decreased wear and tear on plant.

Plants having an output of:

500 Cu. Yds. per day can be built, averaging $ 6,000
800 Cu. Yds. per day can be built, averaging $10,000 to $12,000
2000 Cu. Yds. per day can be built, averaging $15,000 to $20,000

with more than corresponding economies in operation. Should there be an available supply of gravity water, the operating cost may be reduced several cents a yard. Mechanically operated methods of reclaiming the materials, either by steam shovel, drag line, bucket, cable-way or drag scraper, etc., have to take into consideration besides first cost, the upkeep, which, for the wearing parts, is generally very high, when based on considerable output. Transportation charges, cable renewals, pumps, motors, engines, fuel, oil, track, elevators, screens and auxiliary appliances all contribute to the cost of output.

Dredging and dredging methods are economic in reclaiming, but the limited storage and necessity of scows and extra unloading cost at storage end all contribute a proportionate share of cost. The costs of a mechanically operated plant having capacity 500 to 2000 cubic yards per day will rarely fall below 25 cents in first instance and 15 cents for larger output. The washing and screening would alone contribute one-third to one-half of this cost.

Washing and separating into respective sizes, for the Pacific Coast plants is generally made by a novel means: by "Acme" washing and separating device, which has the added advantage of screening, washing and separating the material in respective grades in one operation.

The cost of the above process is astonishingly low. For a 300 cubic yard output the cost covering a two-year period for one plant was .015 cents per cubic yard, including installation, labor, power, repairs and renewals. Here the separation was adapted to a bucket cable-way: total output 136,000 cubic yards. For a 600 yard capacity plant the cost of washing, screening and separating was .011 cents per cubic yard for one year period. For a 1,000 cubic yard capacity plant, hydraulically operated, the cost for a two year period, in which the total output was 410,000 cubic yards, the cost was .008 cents per cubic yard. The itemized cost of operation of this plant, the material, sand and gravel, in almost equal proportions, was as follows:

Sluicing, labor, renewals and repairs....	.042 Cu. Yd.
Screening, washing and separating.....	.008 Cu. Yd.
Loading scows	.010 Cu. Yd.
Power (steam)	.018 Cu. Yd.
Plant depreciation, interest, overhead...	.023 Cu. Yd.

In the operation of the above plant a close check was made in the performance of the separator and washer. The gravel was graded in three sizes—2½"

to ¼", 1½" to ¼", ¾" to ¼". Sand coarse for concrete and fine for building purposes. Samples of graded material checked for voidage from time to time, covering two years' operation. Samples thoroughly dried:

2½" or heavy grade, ran	30%, 31%, 32%.	Silt 0.0
1½" medium grade, ran	33%, 34%.	Silt 0.0
¾" fine grade, ran	35%, 36%, 37%.	Silt 0.0
Coarse sand more variable	29% to 33%.	Silt 0.0
Fine sand	36% to 40%.	Silt 0.0

The efficiency and economy of the separator were well demonstrated, as it requires but one man in attendance to operate to a capacity of 1,000 cubic yards per day and can be erected most anywhere for $2,000, with an annual upkeep of $300 to $600, dependent upon the amount of material handled.

MAKING NON-RESIDENT USERS PAY FOR FARMERS' ROADS

To build and maintain good roads for the benefit or pleasure of non-resident users is a proposition the farmer doesn't relish. Can he escape this burden and still have good roads?

If the experience of the taxpayers of Illinois is of any value there is a way out of the difficulty. According to statements made by Governor Dunne, in an address before the Chicago Association of Commerce, a road policy has been adopted in Illinois which discloses an extremely interesting situation.

It is the purpose of the Illinois Highway Commission to build all leading highways of the most durable materials it is possible to obtain in order that the maintenance factor may be eliminated. To improve the leading roads of the state will require, it is estimated, an expenditure of approximately $180,000,000. Of the roads not improved by the state none will be more than 4½ miles from one of these state-aid roads. At first glance this would seem to be prohibitive in cost, so far as the farmer is concerned. It has developed upon inquiry, however, that the greater part

A concrete road in the Illinois river bottom. Floods ruined all previous roads.

of the construction cost, as well as maintenance, will fall upon corporations and municipalities, and that the farmer's share of the tax, taking the average, will be only 8 cents per acre per year until the bonds mature, which will be at the expiration of about twenty years.

If the estimates of the Highway Commission are correct in so far as they affect the farmer, a man owning 100 acres of land would pay only $8 per year for an improvement worth many times that sum. Instead of being a tax, hard roads of the type Illinois proposes to build will be of direct and immediate pecuniary profit to the farmer taxpayer. They are not an expenditure any more than is the money he puts into seed grain, or a herd of cattle from which he obtains profit. As a matter of fact, the pecuniary return to the farmer through saving of time, cost of transportation and the losses incident to bad roads would be more immediate than in the case of a field of grain. Furthermore, the corporations and municipalities of the state will contribute at least 60 per cent of the money invested in the improved system of roads.

An indestructible concrete road in New York state. This type of highway means minimum maintenance charges.

Turning to the state of New York, it is said that ing in Buffalo, N. Y., November 15, 16 ,17 and 18, 1916. A very the farming sections pay only 15 per cent of the cost of the extended system of highway improvement now being made through state aid. A New York farmer, who complained at a public meeting against "being ground to death by highway taxes," admitted that an improved road in his locality had brought him an offer of $500 more than he had previously considered his property to be worth. He owned a farm assessed at $3,000. He was very frank to state that the increased value of $500 was due entirely to this road. The increase in the value of his farm was sufficient to pay his share of the highway expense for 150 years. The interest on it at 6 per cent for 12 years would pay his proportion of the 50 years bond period. His individual burden amounted to less than one cent a day and would not go over that figure when the highway system is entirely completed. It is needless to say that the farmer in question was surprised and immediately revised his opinion as to the cost and value of permanent roads.

As stated, the Illinois project has to do with main or leading highways only, but it is interesting nevertheless to compare with this the situation in other states as it applies to road tax in general. For example, in one of the leading agricultural counties of Pennsylvania, the county of Bucks, road tax as levied by the townships runs from 4 to 10 mills on each dollar of assessed valuation, depending upon the extent of highway improvement. A fair average would be 6 mills. Thus a farmer owning 100 acres of land assessed at $100 per acre would pay $60 road tax each year. A great majority of the highways are of the most ordinary type, many of them almost impassable at certain seasons of the year. In contrast to this the Illi-

nois farmer will always be in touch with a fine system of durable highways, for the construction of which his contribution of 8 cents per acre will be a mere pittance.

But it is important to remember that the whole success and economy of the Illinois project comprehends the construction of roads of such durable type that they will be in good condition many years after the bonds mature. In other words, there is the purpose to practically eliminate the great burden of maintenance. If it were intended to build merely stone or macadam roads the project would be futile. Roads of this type are obsolete. In the states of Massachusetts, Connecticut, Rhode Island, New York and New Jersey, maintenance costs on macadam roads ran, in 1912, in excess of $800 per mile. The roads were rapidly destroyed by automobiles, and like the New York farmer quoted above, the taxpayers burdened with these excessive maintenance charges had reason to feel that they were being "ground to death."

The Illinois roads will be of brick or concrete. Every other type has been eliminated. The brick roads will have a concrete foundation with the superstructure of brick grouted with Portland cement. A majority of the roads will, of course, be plain concrete roads. Inasmuch as a concrete foundation under a brick road will sustain the superstructure of brick as well as the traffic imposed thereon, it is entirely feasible to dispense with the brick and carry the concrete on up to the required level of the road. By using concrete in this way there will be effected a saving of several thousand dollars per mile over the cost of brick roads. The average cost of concrete roads 16 feet wide, taking the country over, has been $12,000 per mile. In some states, notably in Maryland, Mississippi and Minnesota, narrow concrete roads have been built for about $7,000 per mile.

Wayne county, Mich., has the most remarkable system of concrete roads in the United States. Their construction began about seven years ago. The value of farm lands has, in many instances, more than doubled. Farmers who formerly required four horses to transport their produce to town now use one horse. Where trips to market formerly occupied an entire day, or perhaps two, the journey is now made in a few hours. These roads radiate like the spokes of a wheel with Detroit as their center. The great department stores of the city deliver merchandise over a wide area, going now into what was formerly remote rural districts. In brief, many of these farms, in so far as easy access to the city is concerned, have become suburban properties. The average maintenance on concrete roads 16 feet wide has been less than $30 per mile per year, and in the case of a concrete road built in Bellefontaine, Ohio, more than 20 years ago, a road subject to constant use since that time, the average repair charges have been less than $25 per mile per year. In the state of Connecticut there is a stretch of concrete road four and a half miles long known as the Milford Turnpike. After a year of hard usage it was inspected by engineering experts, who stated that throughout its entire length the road was flawless with the exception of a small hair crack in a single slab.

Concrete roads cannot be transformed into mud or dust. They are built with a very flat crown and a gritty surface texture, which prevents horses and motor cars from slipping. Washouts cannot occur through torrential rains. These roads are passable at all seasons of the year. Their first cost is reasonable and maintenance practically nothing.

FACTORS RESPONSIBLE FOR POOR CONCRETE PAVEMENTS

Factors responsible for poor concrete pavements—(1) No rolling of subgrades, even on fills up to 20 ft. in depth. (2) No wetting of subgrade immediately preceding placing of concrete on the hottest of days. (3) The use of unseparated and unwashed aggregates more commonly called pit-run material used in proportion of the sum of two aggregates when separated. (4) The most careless handling and protection of the aggregates until such time as they are mixed with the cement; I have seen aggregates piled alongside the road, so dust-covered and so thoroughly mixed with dirt from teams driving over them that at first glance one would think these piles of aggregates were simply dirt excavated from the subgrade. (5) Dirty and unclean water used. (6) The concrete poorly and carelessly mixed, handled and placed. (7) The concrete burned and dried too quickly by reason of no covering and lack of wetting down and keeping wet after placing. All of the above conditions are facts, and are factors that tend to make for poor results and are the results of mistakes in judgment, ignorance, and lack of study of the correct methods to be followed—"Concrete Pavements in Western Washington," compiled by Reitze, Storey & Duffy, Inc., Seattle, Wash.

CONCRETE FLOORS

How to Overcome Their Dusting by Proper Construction

The dusting of concrete floors is purely a matter of improper manipulation of the materials in the laying of the floor. This subject has been of considerable interest and study to our engineers. The following letter is typical of the many letters which we send out to our contractor friends on this subject:

"We were very much interested in your letter of the 7th regarding the 'dusting' of the concrete floor you laid. You have been very explicit in your information on how the work was done and we believe we can definitely locate your trouble.

"You must appreciate that Portland cement has certain physical characteristics which must be strictly adhered to. Portland cement takes its initial set from 30 minutes to about two hours after it is mixed with water, and therefore any finishing that you give the floor after the lapse of this time is liable to disturb the initial set of the cement. Eliminating entirely the unsatisfactory floors that are obtained from faulty materials, it is our opinion that often, due to carelessness or lack of knowledge, the top or finishing course upon which depends the abrasion and durability of the floor, has very little care and consideration given to the proper measuring and grading of the materials. We speak particularly here of the water which gauges the mortar. If an excess of water is used in the top course in striking the floor off and troweling it to the desired finish, the water is brought to the surface, and the floor cannot be finished until this water evaporates. Therefore, in many cases the cement gets its initial set before final finishing is done. There is also a tendency among masons to wait a period of time before finishing the floor, as it finishes easier. This disturbs the setting of the cement after it has taken its initial set and is what we consider in the majority of cases the cause of dusting of concrete floors.

"We have gone into considerable detail in this matter as we want to explain to you just what caused your trouble. We believe, if you use care in not having your finishing coat too wet so that it can be troweled to a finish within one-half or three-quarters of an hour after it has been laid, you will have satisfactory results in the future."

White Cement Stucco Houses

The exterior plaster finish of the residence of C. E. Johnson, Milwaukee, Wisconsin, was applied to tile, the first coat of stucco consisting of 1 part gray cement to 2 of sand, with 10% hydrated lime added. The second coat, 2 parts Medusa Waterproofed White Portland Cement to 3 parts sand, and 10% hydrated lime, was floated and left smooth. A little ochre was used in the mixture of the last coat. Fitzhugh Scott, Milwaukee, was the architect.

Residence of C. E. Johnson

The $35,000 home of Chas. Kirchhoff, of the firm of Kirchhoff & Rose, Milwaukee architects, is entirely stuccoed with Medusa Waterproofed White Portland Cement, 2 parts having been used to 3 parts sand, with 10% hydrated lime added. Mr. Kirchhoff wrote quite recently as follows:

"I wish to state that the waterproofing is up to now perfect, and certainly beyond expectations, and as to color, it has turned out beautifully, as the sand which was used was a bank sand, giving it a very tender cream tint.

"The construction of the superstructure of the residence is a balloon frame, using 2″x6″ studding, sheathed on the outside, upon the sheathing two thicknesses of waterproof paper and upon this a 4″ hollow tile split and nailed to the sheathing, then plastered with cement mortar using the Medusa Waterproofed White Cement, showing no cracks of any kind, blisters or any defects. In other words—up to now it is a perfect piece of work."

William Gregory of Milwaukee was the plastering contractor for both residences. Medusa Waterproofed White was furnished by our Milwaukee agents, Tews Lime & Cement Co., who report that a large number of homes were finished in Medusa Waterproofed White the past season and that twice as many will be stuccoed with this material the coming year.

Residence of Chas. Kirchhoff

CONCRETE BLOCK FOR FOUNDATIONS

Enormous quantities of all kinds of building material have been used this year and the demand continues steady and up to the capacity of many of the supply companies.

While the increase has been felt on all sides there are very few establishments that can show the gain made by the Zagelmeyer Cast Stone Company, with plant at Twelfth street and the Detroit Terminal line, Detroit, Mich. The business done so far this year is 125 per cent greater than in a like period last year.

This company specializes in wet process concrete blocks, and these blocks do not need waterproofing.

CONSTRUCTION METHODS TESTED IN DUPONT CONCRETE ROAD

Experiments Made to Determine Effects of Reinforcement and Hydrated Lime in Preventing Transverse Cracks

By CHARLES UPHAM

Chief Engineer, Coleman-DuPont Road, Delaware

Experiments to determine the most suitable methods and materials to use in preventing transverse cracks by means of steel reinforcement and by the addition of hydrated lime, have been a feature in the construction of a 20-mile section of the Coleman-DuPont road in Delaware. No standard length of concrete slab was adopted, as it was decided, in order to learn what the maximum length of slab could be, to place joints only when the concrete mixer stopped for more than 15 min. This has resulted in some very long slabs, the longest being 460 ft. The concrete pavement is 14 ft. wide, 7 in. thick at the center and 5 in. thick at the sides, on a flat subgrade.

Three Kinds of Reinforcement

Three different kinds of steel reinforcement have been used. It was the intention to keep the cost and weight of reinforcement per square yard practically the same for all types of construction.

One section of the road is reinforced for the entire width with No. 29 American Steel & Wire mesh reinforcement. This gives the weight of reinforcement per square yard of pavement as 2.52 lb. Wherever the slab was less than 178 ft. long, no cracks have yet appeared.

Another section of the road is reinforced for the entire width with No. 25 Kahn expanded metal. This gives the weight of reinforcement per square yard of pavement as 2.25 lb. Wherever the slab was less than 164 ft. long, no cracks have yet appeared.

The third section of the road was reinforced with No. 25 Kahn reinforcement for a distance of 4 ft. on each side of the center line. More cracks appeared in this section than where the reinforcement extended the entire width of the pavement.

A fourth section was reinforced with the same material as noted in the preceding paragraph for a distance of 3 ft. on each side of the center line. With the exception of one slab, more cracks have appeared in this section than in either of the other reinforced sections.

The sections where no reinforcement was used have developed cracks, but up to the present time not as many as the sections that were reinforced with the 6 and 8-ft. reinforcement. One reason to account for this may be that the unreinforced section has not been laid as long as the others. With one exception it appears that as the percentage of reinforcement increases the transverse cracks become fewer. The increased cost due to reinforcement was 9 cents per square yard.

Tests With Hydrated Lime

A number of experiments using different amounts of hydrated lime up to 10 per cent by volume were performed. While sufficient time has not elapsed to warrant any definite conclusions, the results promise to be interesting. The only conclusion that can be drawn now as to whether or not the lime is of benefit is from the number of transverse cracks that have developed.

On one section where no lime was used the longest reinforced slab that has not developed a crack is 191 ft. When 10 per cent of lime by volume was used the longest slab to develop no crack was 210 ft. In another instance a slab without reinforcement and using no lime, has developed two cracks, breaking the slab up into three sections, 299, 118 and 126 ft. long, respectively. In two slabs where 10 per cent lime was used no cracks have yet developed; the length of these slabs is 336 and 210 ft.

On another section the longest slab without lime, showing no cracks, was 187 ft. When 5 per cent of lime was used the longest slab without a crack was 245 ft. When 10 per cent of lime was used the longest slab showing no crack was 294 ft. While the data are not sufficient to warrant definite conclusions, they do advocate the use of lime.

SUCCESSFUL TILE AND BLOCK PLANT.

One of the prosperous firms in the business of manufacturing cement tile is that of Tarbox & McCall at Findlay, Ohio. In addition to the block and tile plant, these people have a good-sized shop for the manufacture of ornamental work in concrete, as well as a large quarry and crusher plant for the sale of crushed stone. They are business men of the conservative, substantial type, who know of no better way to build up and maintain a business than to give good, honest, dependable value for the money they receive. They are firm believers in concrete, and Mr. Harry Tarbox, the head of the firm, has exemplified his belief by building himself a handsome concrete residence, which is proving a delight to himself and his family.

In addition to a tile machine the equipment includes a Jaeger-Keny power block machine and two Miller block machines. They have an air compressor for operating the power block machine and a boiler for furnishing steam to the curing chambers, while power is supplied by a 12-horsepower Dunn gas engine.

The screenings from the stone crusher are dumped into a hopper outside and elevated by a bucket conveyor to a screen for proper grading. They operate a No. 4 Universal crusher.

The curing chambers have a capacity of six cars each.

CONCRETE LINING FOR A BRICK TANK

Concrete lining for a brick tank forming part of the water-works plant at Elkhorn, Wis., has been employed to strengthen the tank and make it waterproof. The brick storage tank is 20 ft. diameter and 28 ft. high, with its base 22 ft. below the ground. It was built about 20 years ago and has been in bad condition, so that ground water seeped in and the storage water leaked out. Two sets of forms were made, 3 ft. high, and in eight sections for the complete circle. These sections had 1-in. t.-&-g. sheeting, with 1x6-in. boards at the ends, and three horizontal ribs cut from 1-in. planks. The face of the form was 4 in. from the brick. Wire netting was wired to 60-d. spikes driven into the mortar joints, with their heads projecting about 2 in. A 14-in. concrete floor was laid in advance of the lining, and during the latter work the seepage was so great that a pump had to be kept in operation.

The concrete was 1:5, with pit-run gravel. It was made to a mushy consistency and spouted directly from the mixer into the forms. One form was filled each day, the form beneath (over concrete about 40 hr. old) being removed and replaced above the one just filled. The work was done during cold weather. At the end of work each day the wooden cover of the tank was replaced, and a pipe was led to the inside through which live steam was discharged. The contractor was A. G. Olsen.

LINK-BELT REVISED LIST PRICES

Book No. 275 of the Link-Belt Co. of Chicago represents a revised list of prices of Link-Belt Sprocket-Wheels, Traction Wheels, Gear and Malleable Iron Elevator Buckets.

LANSING FIVE

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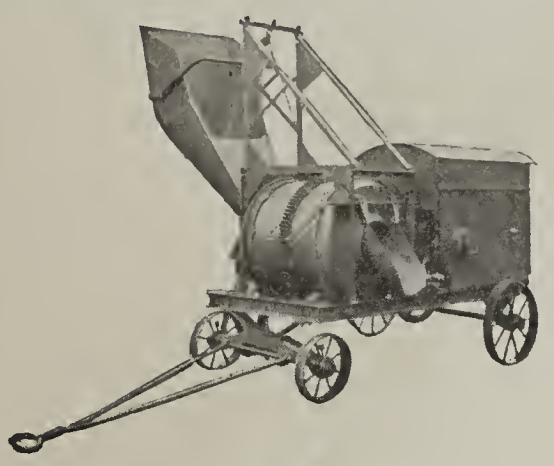

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—Batch Hopper
—Water Tank
—High Wheels
—Wagon Tread

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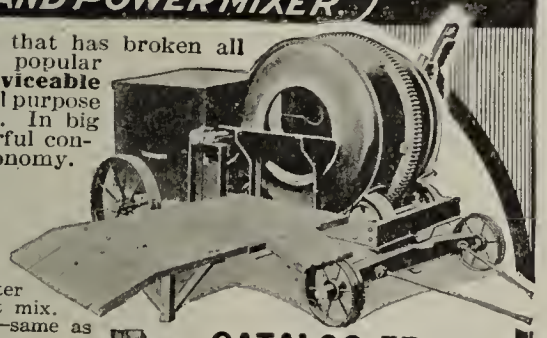

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Gives you full information about all the big Packard features and shows how these wonderful little mixers will insure you bigger profits. Complete specifications on mixers and equipment; also prices, terms, etc. Write.

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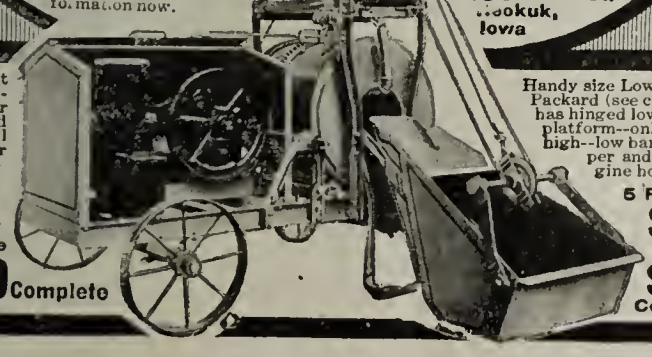

Cut at right shows Packard Mixer equipped with All Steel Power Loader—insures you 50 more batches a day.

5 Ft. Size **$290** Complete

Handy size Low Loading Packard (see cut above) has hinged low loading platform—only 20 in. high—low barrow hopper and steel engine housing.

5 Ft. Size **$185**
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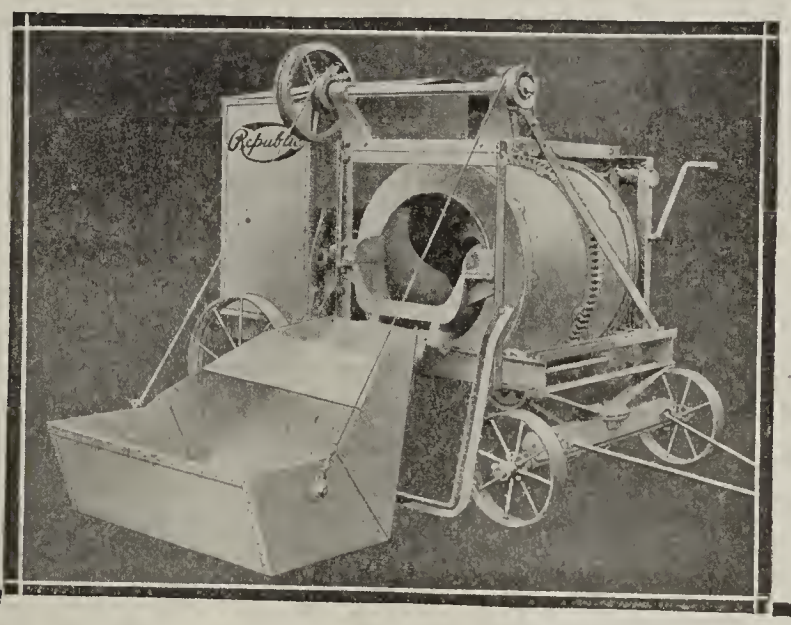

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A good, well-made 10 ft. mixer that combines LIGHTNESS and CAPACITY with STRENGTH and LOW PRICE—making it unusually handy and profitable for either large or small jobs.

Low-Charging Platform if Desired

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Republic Iron Works, Box 454 **Tecumseh, Mich.**

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In building silos or in operating material elevators and derricks, the hoisting engine is almost a necessity. A hoist as connected to a derrick is shown in the illustration in the advertisement of the John F. Byers Machine Company on this page. Both this derrick and the hoisting engine are products of the John F. Byers Machine Company, 260 Sycamore street, Ravenna, Ohio.

This concern have a most complete line of hoists, material elevators, derricks, etc. They are an old established concern, and their product is well known for its reliability and durability. They make either double or single cage material elevators and their hoists are of all sizes and models and are equipped for either steam or electricity. They make derricks in all styles and sizes to fit the many different contracting needs.

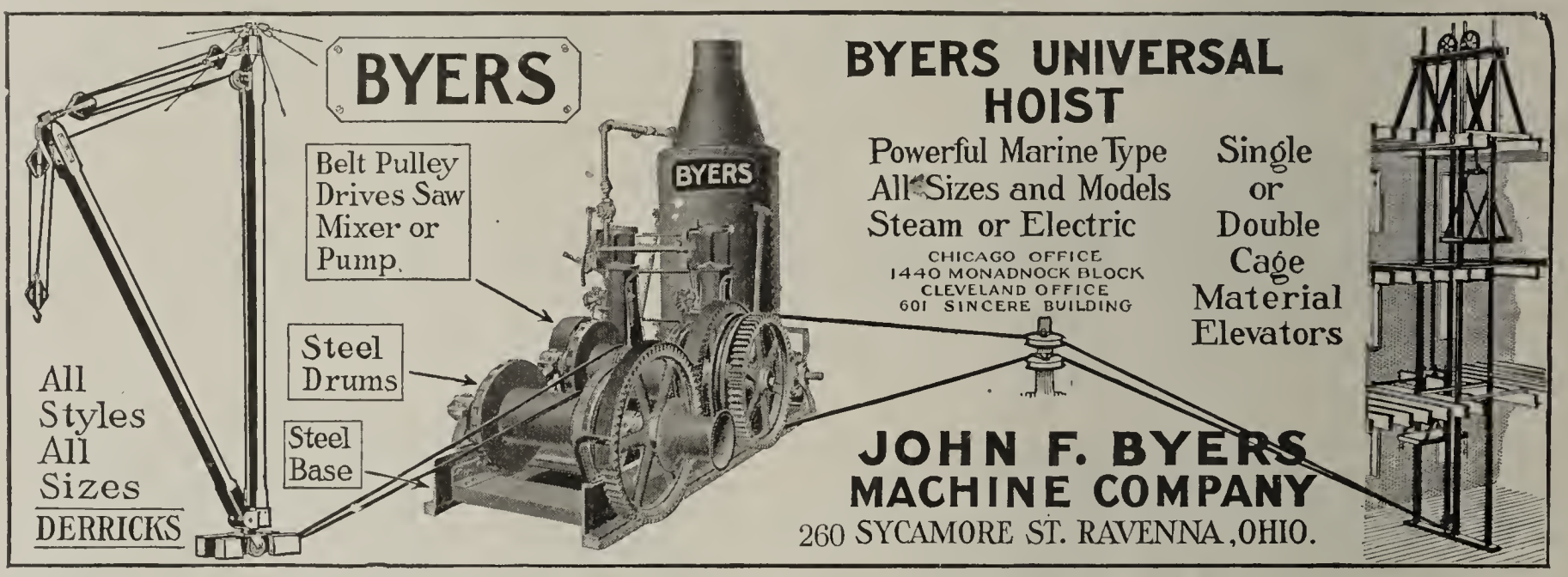
Complete particulars can be secured by any of our readers by writing to this concern at the above address. They will be very glad to furnish all the information that is desired in regard to hoists, derricks, or material elevators.

WRITE FOR THIS BOOKLET

"Waterproofing on the Farm"

The Sandusky Cement Company have just issued a 24-page booklet covering the various uses and advantages of waterproofed concrete work on the farm—horse barns, dairy barns, ice houses, milk houses, creameries, silos, corn cribs, feeding floors, hog houses, hog baths and troughs, root cellars and duck ponds.

Concrete is recognized as the ideal material for farm construction, but it is most important to make it waterproof, and this is fully explained in this booklet. It is well worth writing for. Address Department T-4, Sandusky Cement Company, Cleveland, O., and mention Cement and Engineering News when writing.



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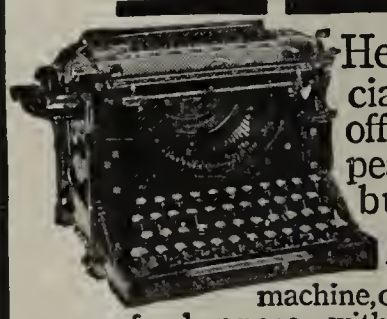
Who Can Use This Machine



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Don't waste money. Write for our war prices, special inducements, and book, "The Truth About Typewriters." Don't even think of taking a step until you read this book of inside secrets and see how much better it is to deal with this reliable, old time house. Send no money—just your name and address today—now.

YOUNG TYPEWRITER CO., Dept. 482 Chicago, Ill.

Northwestern Military & Naval Academy, Lake Geneva, Wis. B uilding of Concrete Units. Marshall & Fox, Chicago, Architects.

A Handsome Concrete Stone Structure

The Face of the Concrete Units Is Composed of Fairly Coarse Aggregates, Brushed Out and Washed a Few Hours After Being Molded.

The Northwestern Military and Naval Academy at Lake Geneva, Wis., now in the course of construction, is being built of concrete stone. A plant was installed last year on the Academy grounds for the manufacture of units of the type known as Hydro-Stone, the work being under the supervision of the Hydro-Stone Co., 259 Insurance Exchange Bldg., Chicago.

The building under construction is classical in design and has been given the same treatment as though built of granite. It is being erected in sections, those now nearing completion being 86x225 ft., two and three stories high. The units are faced with a mixture of mica-spar crystals, white crushed stone and marble-dust and white cement. Some of the trim units were made in special molds. The columns, also of concrete made by the Truss-Wall system, are faced like the rest of the buildings.

The products plant was so located at the site as to give a minimum cost in handling finished material to the building. The rough material, sand, stone, cement and facing material, came in at the rear of the plant and each operation of manufacture brought it closer to the buildings to be erected. The plant itself is composed of several units, the block shed, the special work room, the storage shed for raw materials and an office.

The block shed is the center of the plant and is the base of the arrangement. This contains the block machinery, mixer, the mixing boxes for facing and the racks for freshly made units. The Republic mixer, a one-bag batch, discharges the concrete in place for use in the block machine. The mixing boxes are convenient for facing material to the block machine and to the special work room. The curing racks are so arranged that the longest "carry" for freshly made block is about 20 feet.

The storage shed for raw materials contains the supply of white and gray cement, mica-spar and crushed marble. This shed is a continuation of the block shed, making it convenient to the mixer and facing boxes.

The special work room, in which all casting by hand is done, is placed close to and in line with the block

shed. The central part of the special work room was set aside for the carpenters' work space and the remainder was taken up by bankers on which the molded courses are cast.

The office is so located that it commands a view of and is convenient to all parts of the plant.

Concrete Mixtures

The concrete used in the manufacture of units is made of 1 part Portland cement, 2½ parts of clean, sharp sand, and 2½ parts of crushed gravel ranging in size from ½ inch to 1 inch. The mixture is made wet but not sloppy, so that the water will show when the concrete is spaded once in the pile. This mixture of concrete is used throughout, both in the machine units and in the special work.

The facing used produces the effect of very light granite. The mixture of the facing is 1 part white cement and 2 parts of facing aggregate mixed in the following proportions: two parts No. 3½ mica-spar, one part No. 4 mica-spar, one-half part crushed marble, size 20-30. The facing is made as wet as the rough concrete. The facing should be the same at all times, as any variation in the materials or moisture will show up in the finished block.

Special Molds

The molds for the special courses were so designed that they could be used over and over again. They were carefully made by good carpenters and of first-class material, No. 1 white pine. All faced surfaces were carefully smoothed and shellacked three coats. This prevented the wood from absorbing the moisture from the concrete. The forms were held by adjustable clamps, and in every case they were taken off as soon as the unit was made. Experience has shown that wood molds for molded courses are quite satisfactory when they are well taken care of.

Hydro-stone is being used for all exterior walls and most of the interior walls of the institution. The architects, Marshall & Fox, Chicago, supplied a set of drawings from which elevations of each wall were made. These elevations were laid out in courses and units. The unit size is 12x24 inches. Some courses are less than 12 inches in height and some are higher. The regular courses and some of the special courses are being made on the machine. The special courses, as a rule, are made by hand in the special work room. The large columns were made in Peoria, Ill., by the Truss-Wall system and shipped to the job.

The walls thicknesses are 8 inches, 12 inches, 16 inches and 18 inches. The block, faced and unfaced, for the different thicknesses of wall are being made on the machine simply by changing the core and the fillers in the mold boxes. The jamb block, faced on two sides, the pilaster blocks, faced on three sides, and the odd lengths can be made with the regular equipment of cores and fillers. Wood fillers are made for the molded courses when these are made in the machine.

The machine-made units, faced and unfaced, are produced under mechanical pressure, molded face up, released face down on pallets for racking. The rough, unfaced blocks are placed on racks where they harden. When they are hard enough to handle they are removed to storage. The faced block are given another treatment. They are left on the racks until they have become hard enough for handling and washing. They are then washed or scrubbed with a fibre brush and water. After being washed they are again placed on the racks where they are left for another day before being put in storage. In the manufacture of any concrete unit, steam curing is, of course, a great help, but in this particular case steam is not available. The rough block are made one day and removed to storage the next. The faced block are watched closely and washed at the proper time, 16 hours to 20 hours after they are made. The time for washing depends upon the atmospheric conditions. On cold, damp days the time would be longer than on hot, dry days. While in storage, usually one week or two weeks, the units are kept constantly wet.

In the washing of the faced units, a fiber brush and water are sufficient. On rare occasions a wire brush is sometimes necessary when they have been allowed to harden longer than they should before washing. A wire brush is not so satisfactory, however, as the tendency is to tear the corners and pit the face.

The hand molded units are treated the same as faced block, in regard to washing and handling. The heavier units cast by hand are washed when ready but are left on pallets for a longer time. They have to be quite hard before being placed in storage. The molded courses made on the machine are of simple design and not more than 12 inches in height. It has been found in practice that molded courses which can be made in the machine cost about 40% less per cubic foot than molded courses made by hand in wood molds. The difference is caused by the decreased cost of forms and the greater output per day.

Residence of A. G. Carlson, Chief Mechanical Engineer, Universal Portland Cement Company. This Handsome Residence at 7207 Paxton Ave., Chicago, Is Built of Hydro-Stone.

In the special work room we are making in addition to molded courses, door and window sills, lintels, pilaster bases, necks and caps, soffits for beams, copings and steps cast in unit, all of which are made and faced on the exposed surfaces and according to the full sized details furnished by the architects.

On this job a great saving was made by having made up several feet of each kind of molding, by a millwork house. These moldings were cut and mitred when used.

The cost of Hydro-stone for these buildings presents some interesting comparisons with some of the other building materials of today. Assuming the concrete units in storage ready for the building, they have cost 30% less than common brick with a $20 faced brick. This holds good for all the machine-made material, which included some of the trim courses. The larger units made by hand in woden molds cost in storage about 40% less than the prevailing prices of Bedford stone in the Chicago market.

The Cement Industry of 1915

Potash as a By-Product in Portland Cement Making.

Practically the only unusual features connected with the cement industry in 1915 was the establishment of by-product potash plants by cement manufacturers for the recovery of potash from Portland cement materials. In a report on "Cement in 1915," by Ernest F. Burchard, which is published by the Department of the Interior as Part II of the Mineral Resources of the United States for 1915, it is stated that the collection or elimination of dust in the cement plant is one of the most important problems in cement manufacture at present, and incidental to the study of this problem the year 1915 witnessed an awakening of interest on the part of several cement companies to the possibility of recovering potash as a by-product in cement manufacture. The pioneer in this field was the Riverside (Cal.) Portland Cement Company. The early efforts of the company, which employs the Cottrell electrical precipitation process, controlled by the Western Precipitation Company of Los Angeles, were directed rather toward precipitating waste dust than toward recovering potash, but the company soon discovered that, although the raw mix contained only about 0.2 per cent of potash, the dust contained potash in considerable quantities, and a large portion of it is now being recovered. Since the supply of potash from Germany has been cut off the Riverside company has contracted for the sale of its potash at prices that yield large returns on the investment for the dust-collecting equipment.

The first plant in the East to follow the lead of the Riverside plant is that of the Security Cement & Lime Company at Security, Md.

The limestone used by the Security company in making Portland cement contains more than the average percentage of potash (K_2O), a fact which lends encouragement to the effort to recover it at that plant.

Since 1914, when the production of Portland cement was checked for the first time, manufacturers have exercised caution with a view to correcting the tendency to overproduction, with the result that for 1915 there has been a slight increase in the volume of shipments, a small decrease in the quantity of cement manufactured and a considerable decrease in the stock of cement on hand.

The opening of the year 1915 found the cement industry facing slack times, but with the increasing activity in development work over the country a slight improvement was manifest during the second and third quarters of 1915, and for the last three months of the year there was a marked change for the better, in both demand and prices, so that at the beginning of this year the outlook was brighter than it had been for several seasons.

The distribution of the total marketed production of the three main classes of cement for 1913-1915 is given in the following table:

From this table it is seen that the total quantity of Portland, natural and puzzolan cements shipped from the mills of the United States in 1915 was 87,685,222 barrels, valued at $75,155,102, as compared with 87,257,552 barrels, valued at $80,533,203 in 1914, giving an increase in quantity of 427,670 barrels, or about 0.5 per cent, and a decrease in value of $5,378,101, or 6.7 per cent. The table in which the statistics of these three kinds of cement are combined to form a total in barrels is slightly inconsistent, for the weight per barrel of different kinds of cement are different. A barrel of Portland cement is supposed to weigh 380 pounds net, but the weights of barrels of cement of the other two classes are not uniform. Natural cement is sold in barrels containing 240 to 285 pounds, and generally supposed to contain 265 pounds; puzzolan cement has been supposed to weigh 330 pounds to the barrel, but barrels of it weighing from 240 to 380 have been reported, the weight depending upon the specific gravity of the cement, its fineness, and the number of sacks constituting a barrel. It is suggested that it would be better if all cements could be sold by the hundredweight.

Principal Hydraulic Cements Produced in the United States at Five-Year Periods and For Last Three Years.

	Natural Cement		Portland Cement		Puzzolan Cement		Total	
Year.	Quantity (barrels)	Value	Quantity (barrels)	Value	Quantity (barrels)	Value	Quantity (barrels)	Value
1880	2,030,943	$1,726,707	42,000	$126,000	.....	.....	2,072,943	$1,852,707
1885	4,000,000	3,200,000	150,000	292,500	.....	.....	4,150,000	3,492,500
1890*	7,441,116	3,822,501	335,500	704,050	.....	.....	7,776,616	4,526,551
1895	7,741,077	3,895,424	990,324	1,586,830	.....	.....	8,731,401	5,482,254
1900	8,383,519	3,728,848	8,482,020	9,280,525	365,611	$274,208	17,231,150	13,283,581
1905	4,473,049	2,413,052	35,246,812	33,245,867	382,447	272,614	40,102,308	35,931,533
1910	1,139,239	483,006	76,549,951	68,205,800	95,951	63,286	77,785,141	68,752,092
1913	744,658	345,889	92,097,131	92,557,617	107,313	97,663	92,949,102	93,001,169
1914	751,285	351,370	88,230,170	81,789,368	68,311	63,358	89,049,766	82,204,096
1915	750,863	358,627	85,914,907	73,886,820	42,678	39,801	86,708,448	74,285,248

* The figures for 1890 and previous years are estimates made at the close of each year and are believed to be substantially correct. Since 1890 the official figures are based on practically complete returns from all producers.

As reported by the Geological Survey, the total production of Portland cement in the United States in 1915 was 85,914,907 barrels, valued at $73,886,820. This represents a decrease in quantity of 2.6 per cent, and a decrease in value of nearly 9.7 per cent. The value assigned is computed at a price of 86 cents a barrel, which was the average price per barrel for the whole country in 1915, compared with 92.7 cents in 1914, a decrease of 6.7 cents a barrel, or about 7.2 per cent. This represents the selling price of cement in bulk at the mills, including cost of labor and packing, but not the value of the sacks or barrels. The average price per barrel for the country is 16.1 cents higher than the average price received for Portland cement in the Lehigh district, and is near the average price received in Indiana, Missouri, the Ohio-Western Penn-

sylvania district and the plains states, but falls 53.9 cents below the average received in California, where Portland cement brought the highest price of the year, as it did in 1914.

The quantity of Portland cement made in 1915 is approximately equivalent to 14,574,850 gross tons, and the value per ton is about $5.07. The tonnage of Portland cement made in 1915 was equivalent to nearly 50 per cent of the quantity of pig-iron produced in that year, but the total value of the cement was not quite 19 per cent of the value of the pig-iron. The average value of the cement per ton was about 38 per cent of that of pig-iron.

A resume of the cement industry by commercial districts is given in the report as follows: In 1915, compared with 1914, there was an increase in production in six districts—Lehigh, Michigan-Northeastern Indiana, Maryland-Virginia-West Virginia, Tennessee-Alabama-Georgia, Iowa-Missouri and the great plains states—and an increase in shipments in these districts and in the Ohio-Western Pennsylvania district. There was a decrease in production in six districts—New York, Ohio-Western Pennsylvania, Kentucky-Southern Indiana, Illinois-Northwestern Indiana, the Rocky Mountain States and Pacific Coast—and a decrease in shipments in five districts—New York, Kentucky-Southern Indiana, Illinois-Northwestern Indiana, Rocky Mountains and Pacific Coast. The largest percentage of production, 14.7 per cent, was reported from the Maryland-Virginia-West Virginia district; the largest increase in shipments, 20.3 per cent, was made in Tennessee-Alabama-Georgia district. The northeastern and the western parts of the United States and the Illinois-Indiana-Kentucky region showed the bulk of the decrease in output in 1915.

The net change for the country at large was a decrease in production of 2,315,263 barrels, or 2.6 per cent, and an increase in shipments amounting to 453,725 barrels, or 0.5 per cent. In 1915 the shipments exceeded the production by 976,774 barrels. In no other year since 1912 have shipments exceeded production.

Principal Hydraulic Cements Shipped from Factories in the United States in 1913, 1914 and 1915

	1913		1914		1915	
Class	Quantity (barrels)	Value	Quantity (barrels)	Value	Quantity (barrels)	Value
Portland	88,689,377	$89,106,975	86,437,956	$80,118,475	86,891,681	$74,756,674
Natural	744,658	345,889	751,285	351,370	750,863	358,627
Puzzolan	107,313	97,663	68,311	63,358	42,678	39,801
Total	89,541,348	$89,550,527	87,257,552	$80,533,203	87,685,222	$75,155,102

MOST VALUABLE BOOK ON WATERPROOFING

The Sandusky Cement Co., Cleveland, Ohio, have recently favored this office with their Medusa Waterproofing catalog which is by far the handsomest book they have ever issued on this subject, containing 32 pages handsomely illustrated. From cover to cover this little book has much information as to tests, reports of engineers and others who have used Medusa Waterproofing and cement products. A copy of this catalog may be had for the asking. Write Sandusky Cement Co., Dept. T.5, Cleveland, for a copy of this interesting and useful book.

HOW TO STORE CEMENT

By S. P. Baird, Columbus, O.

It is sometimes thought that only one thing is necessary for the safe and effective storage of cement —a tight roof. Many years' experience has convinced the writer that water-tight storage is not enough, and he has formulated the following principles for cement storage:

1. Cement will retain its strength for an indefinite period when stored in air-tight containers.
2. Cement will be injured less by storing in paper sacks than in cloth sacks, everything else being equal.
3. Cement in any kind of commercial packages will be injured least while in storage if the packages are piled as closely together as possible. In other words, the outside surface of the pile of sacks should be the smallest amount possible.
4. Piles of cement sacks should be covered with a tarpaulin to prevent as far as possible the circulation of air through the pile.

Note the word "tarpaulin"; an ordinary canvas cover is not a tarpaulin, but a paulin. Five parts coal tar, one part gasoline and one part good japan drier make a water-tight black coating for canvas.

Surface condensation often takes place on a stored sack of cement. The moisture is carried into the cement to its very great injury as well as the practical destruction of the sack. The destruction of the sack may not be evidenced at once; but it may be returned to the mill and refilled and sent to some other job, where it bursts and is paid for by a person who was in no way responsible for its condition.

There is a saying among cement men that if you turn your cement—that is, move it from one pile to another—once a month, it will not be injured by an indefinite period of storage. This is not the case; pile it closely and cover it as nearly air-tight as possible and you will have very little caked cement. If the cement is caked it is better to let it alone until you are ready to use it rather than break the cake, thus presenting fresh cement to the action of the air.

CONCRETE PAVEMENTS

Figures recently furnished by the Road Bureau, of the Portland Cement Association, Chicago, indicate that in five states contracts have so far been awarded this year for 1,000,000 or more square yards of concrete pavement. The states and figures are as follows:

Illinois	1,412,789
Ohio	1,391,430
Indiana	1,342,095
New York	1,150,304
Iowa	1,000,291

Michigan, Wisconsin, California and Texas are making good strides toward the million mark, as indicated by the following figures, although it should be mentioned that the records of California were not complete when totals were made up.

Michigan	606,113
Wisconsin	546,203
California	448,749
Texas	530,470

It is interesting to know that most of the yardage in Iowa is for city streets, while the greater portion of the yardage in other states is for country highways.

HOW SHALL A RATIONAL SPECIFICATION FOR GRAVEL BE DEVELOPED?

By C. C. Brown

The consumption of gravel as an aggregate for concrete has been estimated to be nearly 50 per cent of all the aggregates used in the nation. In states having great natural deposits of good gravel, the consumption is much larger in proportion.

Hitherto there has been no rational or complete specification for gravel as an aggregate. The specifications, which are in use, often permit the use of an inferior material, or what is more important and common, exclude gravels which, with proper treatment, will make excellent concrete. In the opinion of the writer, a specification should be rigid enough in its requirements to insure good and uniform concrete, and elastic enough to allow the use of as much of the natural deposits as possible.

No doubt one great reason for this neglect of the specification for gravel is to be found in the fact that there is so much variation in that material, from layers in the same pit or from the pits of the several districts. At the same time practically satisfactory concrete is obtained from these varying gravels without a standard specification, dependence being placed on inspection, subject to individual opinion and experience. This results in a vast waste of good material and in a somewhat lower average of concrete produced therefrom. The relation of the sand and gravel in concrete is so intimate that it is impossible to consider the gravel without considering the sand at the same time, and it is by no means certain that the usual line of division between sand and gravel is the proper line, or that the dividing line should always be at the same point for all gravels.

There have been some studies of the proper proportions of sand and broken stone and fairly satisfactory concrete specifications for mixtures of certain sizes and gradings have been devised. It seems, however, to have been assumed that all other coarse aggregates have the same qualities as broken stone and they are all lumped together under the specification for broken stone concrete.

To secure uniformity of product it is necessary that a "run of bank" or "of plant" gravel be separated into at least two parts, a fine and coarse aggregate, and then be re-combined in some definite pre-determined proportion. The idea of separating and re-combining aggregates probably originated with the paper of Fuller and Thompson published in the Proceedings of the American Society of Civil Engineers in 1907. The principal conclusions brought out by these authors, which are directly applicable to the problem of gravel specifications are these:

1. Artificially graded aggregates give about 14 per cent better strength than naturally graded ones. (In their tests.)

2. Variations in the grading of the sand affect the strength and density more than the grading of coarse aggregate.

3. The term "sand" is a relative one; with a 2¼-in. stone the best sand ranges from ¼-in. to 00, while for ½-in. stone it would range from .05 in. to 00.

From a study of tests on sands the following points are evident:

(1) The average natural sand and gravel screenings are much finer than the so-called straight line of "uniformly" graded sand.

(2) The coarsest sand is not necessarily the strongest. The sand whose curve runs just a little above the uniformly graded sand appears to be the stronger in some cases.

(3) The finest sands are nearly always the weakest.

(4) The amount of material below a No. 80 size, corresponding closely to the size of cement, has a great influence on the strength of the resulting mortar.

(5) The sand which gives the strongest mortar in tension is not necessarily the strongest in compression.

(6) A sand which is all finer than a No. 80 sieve can give better strength and density than one which grades up to ¼ in. if the former is properly graded and the latter is near the upper limit in its amount of fine material.

What has been said concerning the fine aggregate can also be said with reference to the coarse aggregate although variations in grading will probably have less effect on the strength of the resulting concrete. It is clear that there is need of an investigation for the purpose of fixing a rational specification for gravel for concrete. Such a specification should take into account, among other things, the durability of the particles, the grading, the cleanness and the proportions for different classes of natural gravels and for different classes of work.

It does not seem possible that a specification using broken stone aggregates, which are supposed to be roughly cubical but are of quite different shapes according to the structure of the stone from which they are made, would fit gravel, the shapes of the particles of which are so very different. A comparison may be made with the methods used in determining the grading of sizes to be used in the bitulithic pavement. In the original studies for that pavement a cylinder was filled with stones of the largest size proposed to be used and they were shaken down until no more could be put in. The voids were then filled with plaster of paris, the mass was carefully disintegrated and the sizes and shapes of the voids between the stones were determined. A similar study of the voids in gravel would soon demonstrate the truth or the falsity of our contention that the voids are different in size and shape from those in broken stone and that they require a different proportioning and limits and grading of the fine aggregates.

The writers of this paper have been interested particularly in the gravels of Indiana, and have studied the deposits in that state and the concrete made from the various kinds of gravel. As a result of this study a program of tests of the various sands and gravels has been devised.

This program provides for a collection of samples from a sufficient number of gravel deposits in the state, as the material is furnished commercially, to determine the physical characteristics of the gravels. A determination will be made of the best grading of sizes to produce the strongest mortar, using sand passing various sizes of screen, and various proportions of cement and sand. Coarse gravel will be studied in like manner to determine the best concrete that can be made from it, the sand grading producing the best mortar to be used in each case. The samples obtained from the various deposits as delivered to customers commercially will then be tested to determine how nearly they approach the ideal grading determined by the tests.

From the data thus obtained, it is believed that specifications can be formulated, under which the good commercial gravel products of the state can be tested and accepted, so that we can at the same time utilize practically all the valuable gravel deposits, reject those not capable of producing good concrete, and have definite standards and methods of applying them.

CEMENT AND ENGINEERING NEWS

(PUBLISHED MONTHLY)

WILLIAM SEAFERT, Editor and Publisher

Office—672 Transportation Building, Chicago

Telephone, Harrison 5397 Cable Address, "Seaferts" Chicago

Entered at the Post Offfce at Chicago, as second-class matter, July 21, 1896 under Act of March 3, 1879

SUBSCRIPTION RATES:

United States, Canada, Philippine Islands and Mexico, $1.00 per year; all other countries, $1.50 per year.

DISCONTINUANCES—The greater part of our subscribers prefer NOT to have their subscriptions interrupted, in case they fail to remit promptly for renewal. It is therefore assumed, unless notification is given to the contrary, that the subscriber wishes to continue taking our paper. Therefore CEMENT & ENr GINEERING NEWS will be sent until we are notified to discontinue—Such notice should be sent when the subscription expires.

Advertising copy or changes in ads. must be in this office by the 25th of each month, as hereafter our magazine will appear on the 5th of the following month

Advertising Rates Sent on Application

JOHN F. WALDRON - - - - - - - - Advertising Manage

CHICAGO, OCTOBER, 1916

COUNTRY CONFRONTED WITH SERIOUS CAR SHORTAGE

You remember the car situation in 1907 and 1912. The business of the country was seriously interfered with, due to the inability of producers and manufacturers to ship and of retailers to get supplies to meet the pressing demand. Money was lost because normal trade could not be carried on.

Yet in neither 1907 nor 1912 were the net surpluses of box cars on August 1 as low as on that date this year. As evidence of the gravity of the situation, warnings have been issued by the Federal Trade Commission, the Interstate Commerce Commission and the various state public utilities commissions with the message that the car shortage will cripple business unless every car is made to do maximum duty. The plea to shippers is to load quickly and to receivers of freight to unload quickly so that cars will get back into action. We quote from the warning of the Interstate Commerce Commission:

"The commission takes this opportunity of again bringing to the attention of the carriers and shippers the necessity of close supervision of the methods of loading, unloading and moving cars so as to secure the fullest possible use of available equipment.

"The commission feels justified in urging upon shippers and consignees that they shall not use cars for storage purposes, but should endeavor to release them as promptly as possible and not avail themselves of the full limit of free time provided by the tariffs."

From the railroads came another warning. The demurrage committee of the American Railway Association, in conference with the National Industrial Traffic League at Detroit, August 15, announced its intention to seek authority from the Interstate Commerce Commission to raise demurrage rates to such a figure as to make quick unloading imperative. The proposal is to allow two days without cost, to charge $2.00 for the first day over the free allowance, $3.00 for the second day, $4.00 for the third and $5.00 for the fourth, and all succeeding days over the free allowance. This would be practically a prohibitive rate and would force cars back into service. A further proposal is to change the clause regarding interference of bad weather so that demurrage would be charged regardless of rain. These have not received the sanction as yet of the Interstate Commerce Commission but show the gravity of the situation.

Many far sighted buyers of materials in carload lots have seen the approaching trouble and have increased their stocks to the maximum. But the time has passed for stocking warehouses to capacity. If they were generally to practice this at the present time the shortage would only be aggravated. They can, however, avoid embarrassment by anticipating delays and ordering in advance of actual needs.

The rules of the railroads regarding routing of cars are very strict. For instance, manufacturers must ship a Pennsylvania car via the Pennsylvania, and a C., M. & St. P. car via the C., M. & St. P. They are not permitted to ship a Pennsylvania car over the B. & O. or a C., M. & St. P. via the C. & N. W.

At times shippers are able to get cars from one or two railroads when they are short cars of other lines. Yet they are not allowed to use cars of the road furnishing an ample supply to fill orders for cars routed over lines of whose cars they are short.

In other words, there may be a surplus of cars of one line and a shortage of another. This surplus may be of one road today and of another tomorrow. The daily supply of cars furnished to large shippers is seldom of the exact assortment needed.

When retailers anticipate requirements, specifying shipment on or before a certain date, it will be possible often for shippers to use this surplus. When a temporary surplus of cars of one road occurs, shipments will be made of cars due to go out several days later, which is far more satisfactory to the receiver than a delay of a week or ten days after a specified date of shipment. Without this opportunity to use surplus car supply by filling orders ahead it is often difficult to make immediate use of such cars.

Specifically, then, receivers of carload freight will safeguard their own interests by ordering well in advance of needs, anticipating future requirements and giving as much leeway as possible in time of shipment.

In addition, receivers may help the situation by prompt unloading of cars and by giving leeway as to car size. For instance, cement manufacturers could load 144 barrels into a 173-barrel car, but this involves a waste of 29 barrels of car capacity for the period of transit. This is no time to permit waste. Wasteful methods will cause financial loss to all shippers. Cement dealers, therefore, should make orders read "one car (any size)" or "two cars (any size)." This will permit loading what cars may be on hand. If the size must be limited, give leeway, such as "one car, 173 to 231 barrels." The same opportunity to conserve car supplies is true in other lines of building supplies as well.

Conditions are such that there are not enough cars to go around. All large shippers will be short. Business will suffer. The situation today is not one which can be helped except by the hearty support of every shipper and receiver of freight to cut down waste capacity and avoid lost time.

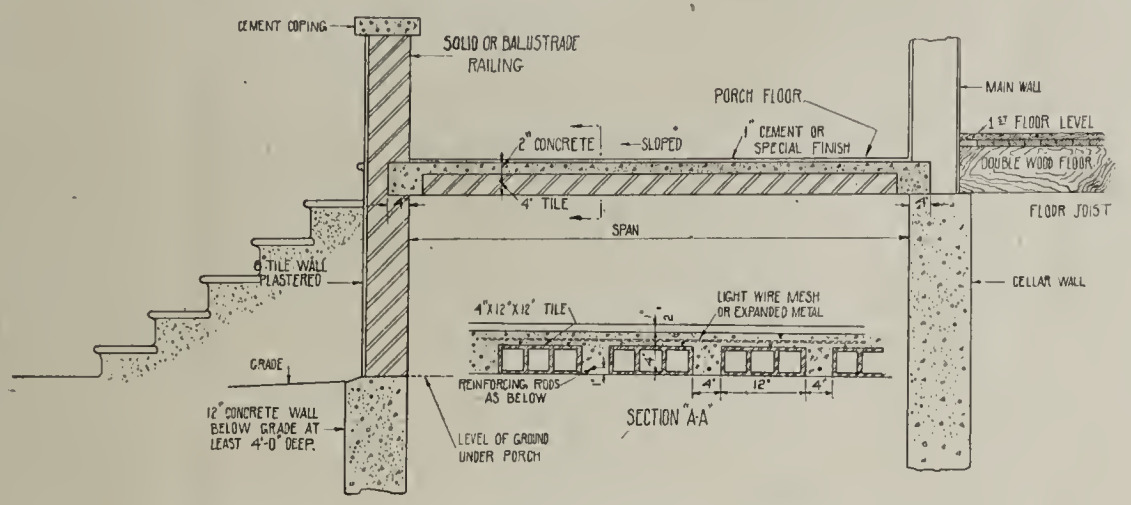
NEW CEMENT MILL IN OREGON

According to Clark M. Moore, general sales manager of the Oregon Portland Cement Co., Portland, Oregon, the new plant which began operation the latter part of May, 1916, is producing a daily average of 1,000 barrels through its 10x210 ft. kiln. The company is using the wet process, being supplied with raw material from quarries at Roseburg and Dallas, Oregon.

The Construction of Concrete Porch Floors and Steps

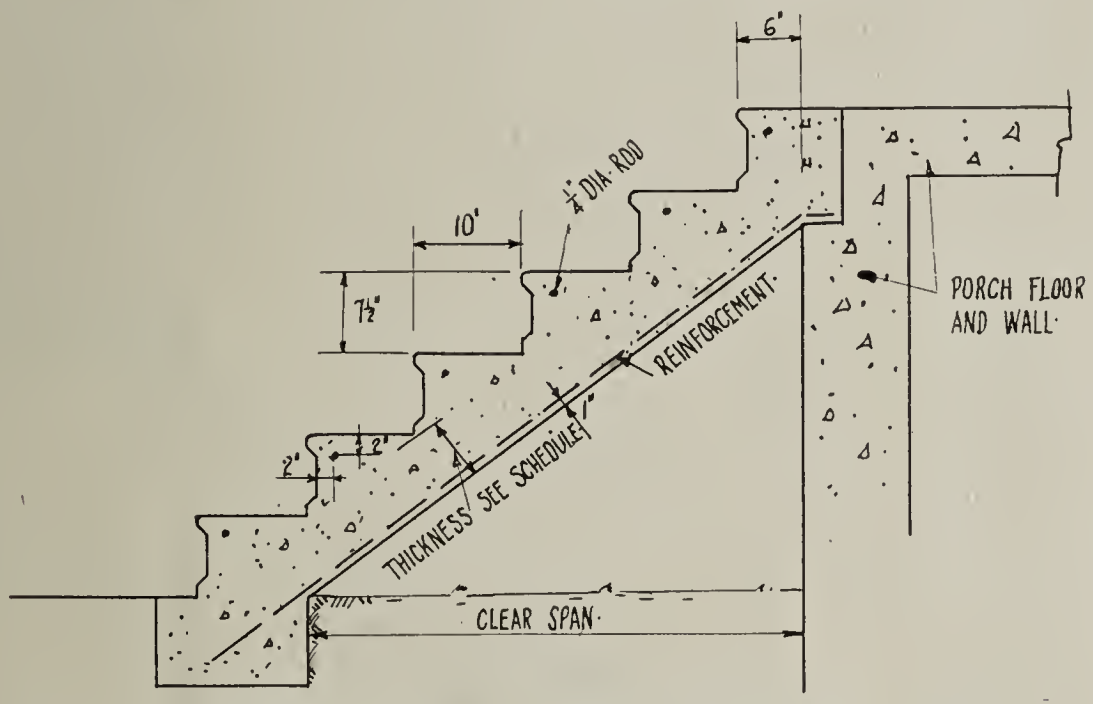
We are presenting this month the first installment of details of simple concrete structures that will be covered sufficiently to enable contractors or builders not doing the class of work covered to enlarge their field of activity with resultant new business and profit.

We have had many inquiries regarding the construction of a concrete porch, and the accompanying detail of porch floor construction gives a very simple and economical construction.



Sketch No. 1. Reinforced Concrete Porch Floors.

The incorporation of a 4-inch tile in the floor, as shown, provides a lighter floor slab, yet one which is strong enough to sustain any load which will come on it. The table of reinforcing given below covers the size of rods in each rib required for different lengths of span.



Sketch No. 2. Reinforced Concrete Steps.

Table of Reinforcement for Porch Floors

Span	Steel in Each Rib	Span	Steel in Each Rib
5'-0"	⅜ Rd. Rods	5'-6"	9'-0"	½ Sq. Rods	9'-6"
6'-0"	⅜ Rd. Rods	6'-6"	10'-0"	⅝ Rd. Rods	10'-6"
7'-0"	⅜ Sq. Rods	7'-6"	11'-0"	⅝ Sq. Rods	11'-6"
8'-0"	½ Rd. Rods	8'-6"	12'-0"	⅝ Sq. Rods	12'-6"

The forms for porch floors are very simple because the under surface is smooth and it is only necessary to construct a flooring on 4x4 uprights and 3x6 joints which will be adequate to sustain the weight of the floor during construction.

Two details covering different types of stair construction are shown. Where an earth fill underneath the steps is possible it is a more simple construction than where a reinforced concrete stair must be made extending from the porch floor down to the ground. This divides stairs into two classes: those built on a slope either in cut or fill, and reinforced concrete stairs which are self supporting.

Sketch No. 3 shows forms for concrete steps that are built on the ground and not reinforced. The forms for this type of step construction consists of two planks braced again the sidewalls by 4x4's and wedges. To these are nailed 2x4's which come to within a couple of inches of the treads. To the 2x4's are nailed the cross planks which form the risers. In actual construction it is better to fasten the 2x4's to the planks in their proper position before the planks are braced against the wall.

The forms for the risers can be stripped 24 hours after the concrete is poured and the face of the riser finished to a smooth surface by rubbing with a wood float dipped in water and sand.

It will be noticed that the planks forming the risers are bevelled at the bottom to allow the finishing of the entire tread.

Where concrete steps are built without side walls a different form is used. It is made of planks cut according to the risers and treads of the steps, and the forms for the risers are nailed to the plank. This form is practically the same as for reinforced concrete steps shown in sketch No. 4.

As soon as the concrete base is poured, the treads should be finished. The mixture should not be too sloppy or the concrete at the bottom of the stairs will

be forced over the riser forms by the pressure of the concrete above. A 1:2½:5 mixture may be used for the base of the steps with a surface ¾ inch mortar coat of 1:2.

Reinforced Concrete Stairs

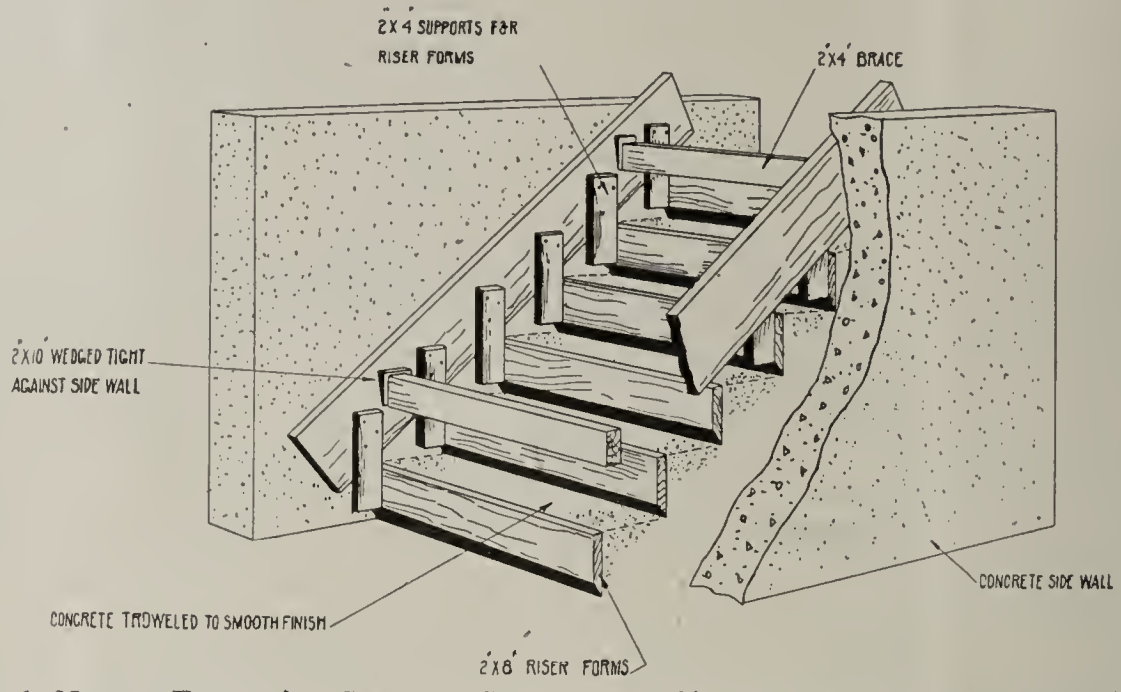
Stairs that are not constructed on an earth fill must be self-supporting, and, hence, must be reinforced. The reinforcing steel should be placed in the bottom of the slab, one inch from the under side running lengthwise, and will vary according to the length of the slab. The reinforcing for different length stairs is shown in sketch No. 2.

The forms required for self-supporting stairs are shown in the accompanying sketch. It consists of a panel of ⅞-inch tongue and groove sheathing cleated together, and about 12 to 14 inches wider on each side than the stairs. This panel is supported on 4x4's longitudinally, which in turn are supported on 4x4 bents as shown. The planks forming the side forms are nailed to the panels and braced on the outside.

The entire slab should be poured at one time. The longitudinal reinforcement should be placed before the forms for the risers are attached and the rods in the edge of the steps placed when the concrete is poured. The mixture used should be 1 part cement, 2 parts sand and 4 parts stone or screened gravel. The ¾-inch surfacing should be placed continuous with the pouring of the concrete in order that bond is obtained between the finishing mortar and the concrete comprising the slab.

The side and riser forms can be removed 24 hours after the concrete is poured, but the forms and shoring supporting the stairs slab should be left in place at least four weeks.

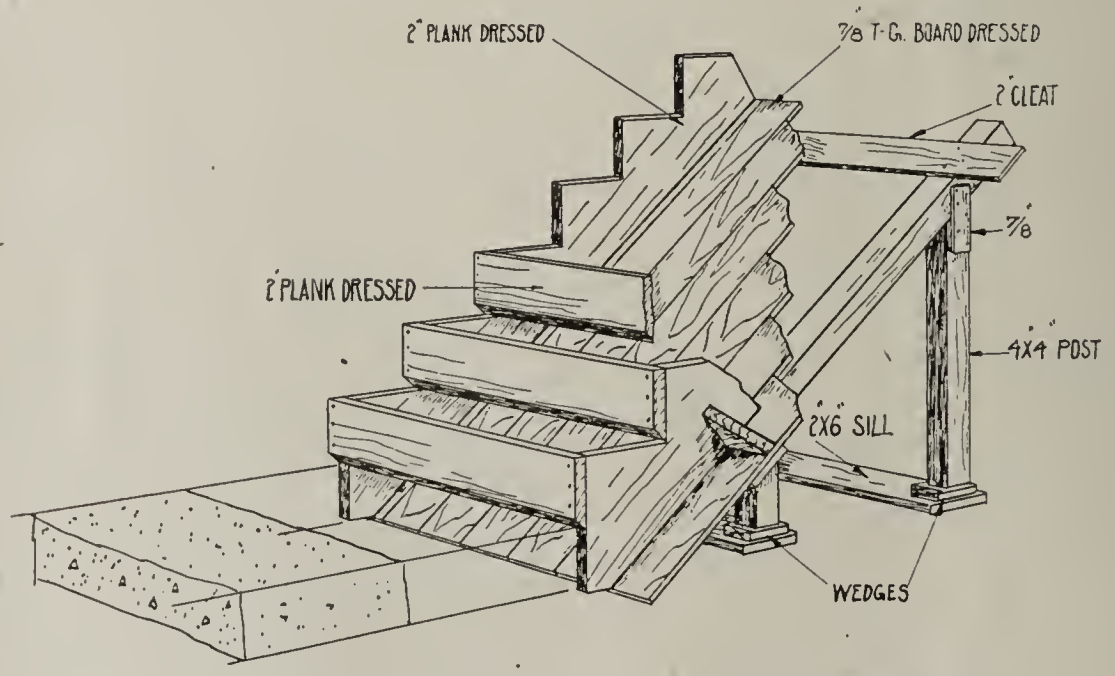
Sketches Nos. 5, 6 and 7 show three types of riser forms which have proven satisfactory.


2X4 SUPPORTS FOR RISER FORMS
2X4 BRACE
2X10 WEDGED TIGHT AGAINST SIDE WALL
CONCRETE TROWELED TO SMOOTH FINISH
2X8 RISER FORMS
CONCRETE SIDE WALL

Sketch No. 3. Forms for Concrete Steps When Side Walls Are Already in Place.

Table of Reinforcement for Concrete Stairs

No. of Steps	Clear Span	Thickness	Reinforcement Dia.	Reinforcement C.C.	No. of Steps	Clear Span	Thickness	Reinforcement Dia.	Reinforcement C.C.
4	2'- 2"	4"	¼"	10"	8	5'-6"	5"	¼"	5"
5	3'- 0"	4"	¼"	10"	9	6'-4"	6"	¼"	5"
6	3'-10"	4"	¼"	7"	10	7'-2"	6"	⅜"	8"
7	4'- 8"	5"	¼"	7"	11	8'-0"	6"	⅜"	6"



Sketch No. 4. Forms for Reinforced Concrete Steps.

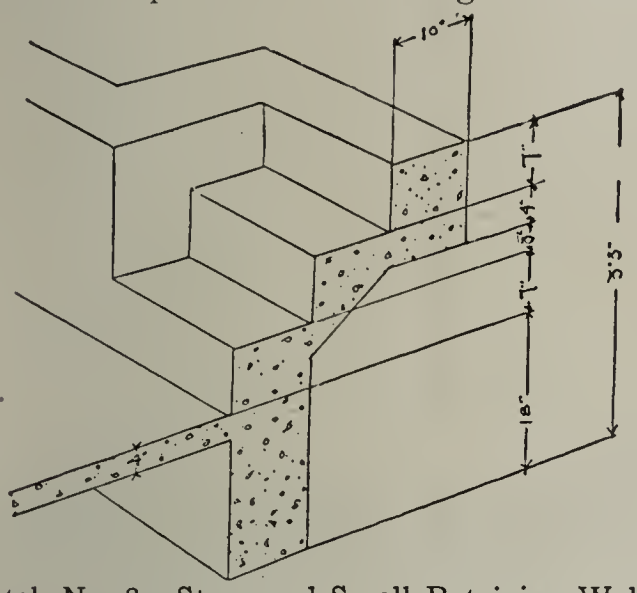
When steps are to be used a great deal, it is best to protect the tread. There are several ways of doing this, as are shown in sketches Nos. 5, 6 and 7. One kind of protection, and the most commonly used, is a safety tread made up of a steel plate with soft metal

inserts in the surface. Lugs are attached to the under side. These safety treads are placed in position while the concrete is still soft.

Another form is a metallic nosing such as is used in curbs, and is most used when heavy objects are moved up and down the stairs.

INFORMATION WANTED

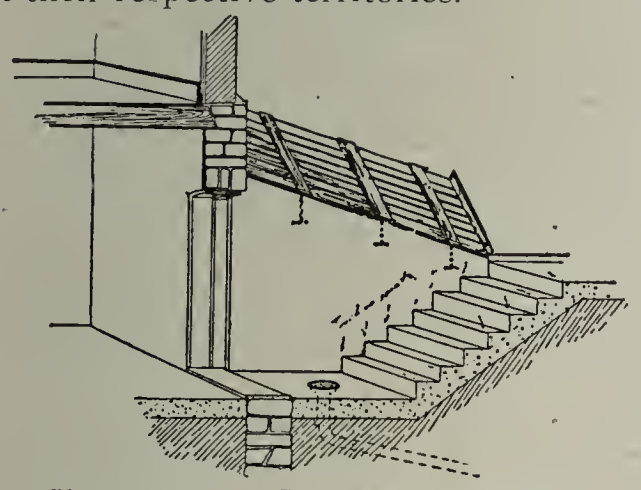
The secretary of the American Concrete Pipe Association is in receipt of the following letter from Mr.



Sketch No. 8. Steps and Small Retaining Wall.

C. M. Wood, manager of the Cement Products Bureau of the Portland Cement Association:

"This association is endeavoring to prepare a complete list of the cement products manufacturers of this country. In addition to preparing this list, it is the hope of being able to learn just what products these various parties manufacture. With information of this nature in our files we will be able to co-operate more efficiently with them in the promotion of concrete products, and they naturally will receive the benefit of the inquiries which we are able to turn to them from parties in their respective territories.



Sketch No. 9. Concrete Hatchway.

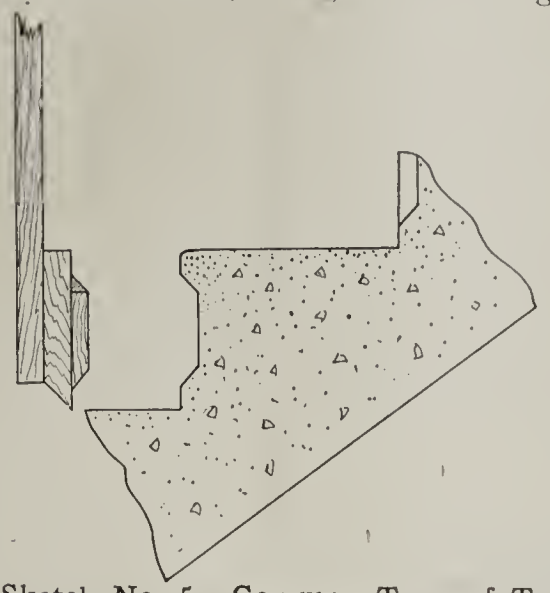
"A short time ago a letter was sent to practically all of the cement products manufacturers in the United States, enclosing a form on which certain information was requested. While a great many of the cement products companies have responded in a very cordial manner to our efforts, we have not as yet heard from a large number, and we feel that with the circulation of your magazine you may be able to get in touch with and urge these parties to forward to the Portland Cement Association the form properly filled out."

Such a compilation ought to be of much value in aiding the Portland Cement Association to be of service to products manufacturers, and it is hoped that readers of Cement & Engineering News will cheerfully respond if they have not already done so.

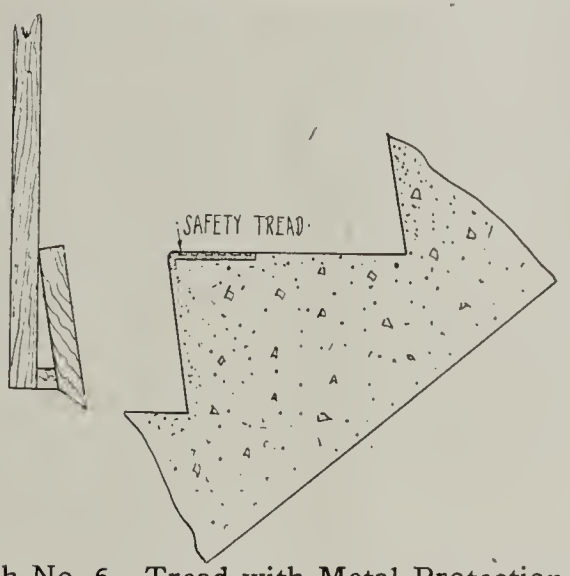
COLORS FOR CONCRETE WORK

A San Francisco contractor, writing to the *Architect and Engineer,* tells how to color cement. He says:

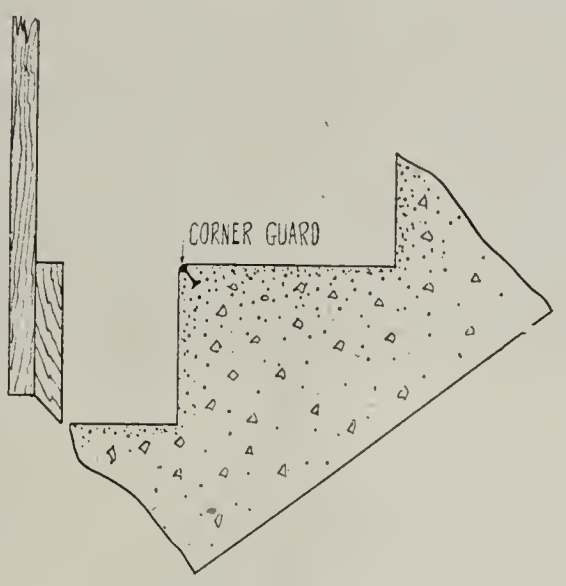
The colors will not fade if the directions are closely followed. These recipes were given me some years ago, and I find that, wherever tried, they have proven to be all that was expected of them. The quantities are given per barrel of cement, the coloring matter in each instance being mixed with the cement and sand. Caution is given that venetian red and common lampblack should not be used, as the color obtained with these materials will run and fade. The various colors and quantities of coloring materials for each barrel of cement are as follows:



Sketch No. 5. Common Type of Tread.



Sketch No. 6. Tread with Metal Protection Plate.



Sketch No. 7. Plain Tread with Corner Guard.

For brown, 25 lbs. of best roasted iron oxide; or 15 lbs. to 20 lbs. of brown ochre.

For black, 45 lbs. of manganese dioxide.

For blue, 19 lbs. of ultramarine.

For buff, 15 lbs. of ochre. (This is likely to reduce considerably the strength of the mixture.)

For green, 23 lbs. of greenish-blue ultramarine.

For gray, 2 lbs. of boneblack.

For red, 22 lbs. of raw iron oxide.

For bright red, 22 lbs. of Pompeiian or bright vermilion.

A Modern Hydrated Lime Plant

The Vermont Marble Company of Proctor, Vt., have just put into operation one of the finest Rotary Kiln and Hydrated Lime Manufacturing Plants in existence. This plant is located at West Rutland, Vt., and was built for the purpose of utilizing waste products from the various operations of the Company, their purpose being to turn this waste into valuable Chemical, Hydrated and Agricultural Lime Products. The waste material being brought in from the quarries and factories is discharged directly to a No. 6 crusher, unless the lumps are so large that it requires an earlier preparation, in which case it is elevated and put into the large 60x48 inch Superior Jaw Crusher. This crusher reduces the stone to 6 in. and under, and the discharge from the crusher is arranged to flow directly into the No. 6 Gyratory Crusher. Leaving the No. 6 crusher, the limestone is lifted and discharged directly into a Rotary Screen which eliminates the fines allowing the coarser material to pass to a 36x18 inch roll crusher, which reduces to the same fineness as the screen product, both streams flowing directly to a common elevator discharging onto a belt conveyor. At this point the very fines are screened out and conveyed over to the Pulverized Agricultural Limestone Department. The coarser materials being discharged to a large circular tank, for night operation or for making the operation continuous, and also to the large storage bin above the Rotary Kiln. The crushers were furnished by Worthington Pump & Machinery Corporation, Cudahy, Wis. and New York City.

The Kiln Department has been made sufficiently large so that a second complete unit can be installed, each unit consisting of one 8′x125′ Rotary Kiln with the Storage Bins and one 5′x50′ Vulcan Rotary Cooler. The storage bin above the Kiln is arranged with a cradle type of feeder operated from the Kiln driving mechanism, so that the flow of the material is under control at all times.

The Kiln was made in Wilkes-Barre, Pa., by the Vulcan Iron Works and is fired by Producer Gas which is generated in a separate building and led over to the Kiln by means of a Gas Flue. The discharge from the Rotary Kiln flows by gravity directly to the 5′x50′ Vulcan Rotary Cooler. The burned lime discharging from the Cooler flows directly to an elevator discharging into the two large Oxide Bins, through screens which eliminate any coarse or foreign unburnt material.

One of these Oxide Bins is arranged to feed directly into an elevator discharging to a "Kritzer" six-cylinder Hydrating Machine. The other Oxide Bin is so arranged that its contents can also be conveyed to the "Kritzer" Hydrator, but this bin was installed primarily for the purpose of loading the lime in Oxide form directly into cars for shipment.

The New Lime Hydrating Plant of the Vermont Marble Company Equipped with Raymond Automatic Pulverizer, Superior Jaw Crushers, a 30″x16″ Superior Crushing Roll, and a Fuller Lehigh Limestone Pulverizer.

The Hydrating equipment consists of the following:

One No. 4 Six-Cylinder Kritzer Hydrator.

Two Raymond Air Separating and Dust Collecting Outfits.

Two Beater Mills.

Following this equipment there is installed a large compartment bin arranged for packing the various qualities of lime products in a "Bates" Four-Tube Lime Packing Machine located below; a dust collector system is also installed in connection with this packer.

The Stock House is arranged for the storage of the Hydrated Lime packed in bags. This building has a capacity of from 1,500 to 2,000 tons.

Gas Producer House: The fuel for burning is

brought in and discharged directly into a Hopper below the track and is then carried by means of a belt conveyor to a crusher discharging directly to an elevator discharging to a belt conveyor leading to the bin above the gas producer or discharging directly to the covered coal storage. This storage has a capacity of from 250 to 300 tons. The Gas Producer is of the "Chapman" Mechanical Type, and this Producer installation is modern in every particular.

In general, the buildings are of steel frame construction covered with corrugated iron siding and roofing. The various machines throughout the plant are amply proportioned for the various operations and each machine is driven by individual motors, furnished by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

The power for operating the plant is received from the Hydro Electric Stations owned by the Vermont Marble Company.

Raymond pulverizing air-separating system was furnished by Raymond Bros. Impact Pulverizer Company, Chicago, Ill.

The whole plant is laid out for future extensions.

There is also a department for pulverizing lime for agricultural purposes. This equipment consists of one 33" Fuller Lehigh Pulverizer with its accessories. An additional Stock House and shipping facilities are arranged in connection with this Department.

This plant has a capacity of 75 tons of Hydrated Lime daily and 50 tons of Agricultural Lime, and in addition to the above, arrangements have been made so that crushed stone for fluxing or other purposes can be shipped.

The large crusher (furnished by Worthington Pump & Machinery Corp.) has a capacity of some 240 tons per hour, which is sufficient for all later extensions, but this crusher was installed originally for the purpose of reducing large lumps which otherwise could not be handled satisfactorily.

This plant is the most modern Rotary Kiln Hydrated Lime Plant in existence. It was designed and constructed by the Fuller Engineering Company of Allentown, Pa.

THE NEW MILL OF THE HANOVER GYPSUM COMPANY

The modern mill of the Hanover Gypsum Company at Hanover, Montana, a point on the Chicago, Milwaukee and Saint Paul Lines and the Great Northern tracks—is now completed and in operation.

The plant is unusually favored in transportation facilities as two transcontinental lines—the Chicago, Milwaukee and Saint Paul and the Great Northern—cross the property and pass within six hundred feet of the raw material deposit. At this point the two tracks are less than seventy feet apart and a connecting track has been completed for interchange service. Tracks from the Chicago, Milwaukee and Saint Paul Lines serve the mill and with the interchange connection the works have a distribution over the Great Northern Lines covering—

North Dakota—Western Section
Montana—Northern and Central Section
Wyoming—Northern Section
Washington—Northern and Central Section
Pacific Coast
Canadian Points

and via the Chicago, Milwaukee and Saint Paul Lines. A wide territory is open covering South Dakota—Western Section
Montana—Central and Southern Sections
Washington—Central Section
Pacific Coast Points
Canadian District

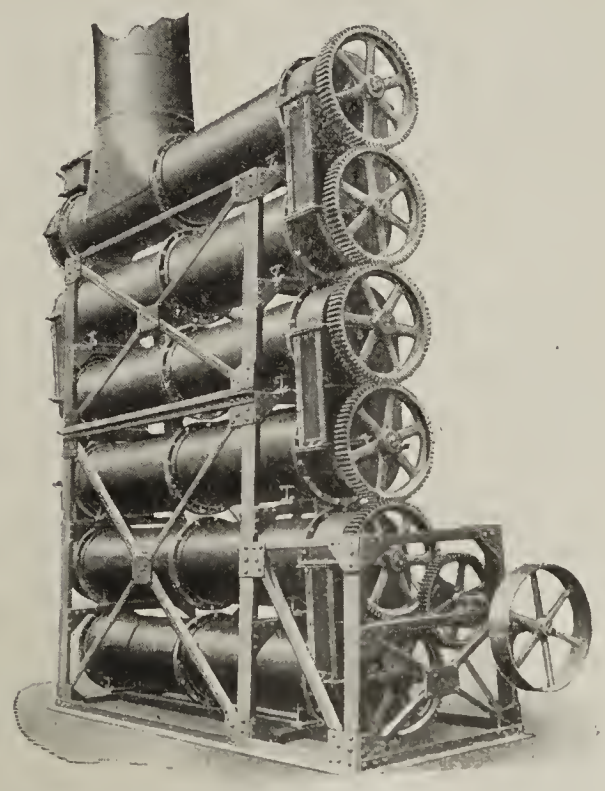
The two lines unquestionably provide the "Hanover Works" with unequalled transportation facilities—and an unusual field for the marketing of the raw and manufactured product.

The mill is thoroughly modern and equipped with the highest class mechanical equipment including—

Jaw Crushers—Heavy type
Rotary Dryers
Raymond Mills
Calcining Kettles

and is electrically operated throughout. Westinghouse Electric & Manufacturing Co., Pittsburg, Pa., furnished the electrical equipment. The pulverizing, air separating system was installed by Raymond Bros. Impact

The 8'x125' Vulcan Kiln Installed in the Hydrated Lime Plant of the Vermont Marble Company.



The Kritzer Continuous Hydrator, Installed in the Lime Hydrating Plant of Vermont Marble Company.

Pulverizer Co., Chicago, Ill. The rotary dryers were furnished by The Bounot Company, Canton, O.

The capacity is six hundred tons of raw material per ten hours day and two hundred tons additional of finished product. This output can be increased at minor costs and the mill is designed in the unit form allowing for expansion without a suspension of operations or alteration costs.

The raw materials are of unusual quality and approximately four million tons have been blocked out in the quarry and mines. The tonnage available to opening quarrying will operate the mill for fifteen years and the further tonnage from mine operations is practically unexhaustible. Howells rock drills are used in the quarry, furnished by the Howells Mining Drill Co., Plymouth, Pa.

The quantity of the raw material is proven by the following average analysis—

Silica & Insoluble	.92%
Alumina & Iron Oxide	.70
Lime	34.6
Sylphuric Anhydride	43.
Combined Water	20.78
	100.00%

and from a series of manufacturing tests plaster of a quality fully equal or superior to the best plaster in the United States can be produced.

The marketing of "Hanover" plaster will be through the recognized building material dealers in the northwest and the active sales work will begin in the ensuing ten days. The general offices of the company are in the Bank Electric Building at Lewistown, Montana, and a coast office will be established in Seattle for direct service to the coast trade.

The officers of the company are—
Dan R. Brown, President,
George J. Weideman, Vice-President,
Orville U. Miracle, Treasurer,
H. V. Alward, Secretary,
Frank H. Schulz, General Superintendent, and the company is a closed corporation with a very limited number of stockholders.

Since the above article was written the Hanover Gypsum Company has been purchased outright by the Cement Securities Company, who operate cement mills at Denver, Colo., and Trident, Montana. They intend to immediately erect a 1,000 barrel cement plant on the land formerly owned by the Hanover Gypsum Company. This tract of land contains an abundance of the highest grade cement material as well as large beds of pure gypsum.

"THE MEDUSA WHITE HOUSE".

The above name is the title of a little booklet that is being distributed by the Sandusky Cement Company describing the value and use of cement as applied to modern home building.

A point that is brought out particularly in regard to the use of cement and concrete for this purpose is the fact that this material lends itself more readily to all varieties of treatments, to suit the many individual tastes, than any other building material.

The uses for which gray and white Medusa Portland Cement are intended and the value of waterproofed cement are discussed in a way that will appeal to the home builder. The arguments as presented in the booklet will be of value to the contractor in impressing the good points of concrete and cement construction on prospective builders of all kinds.

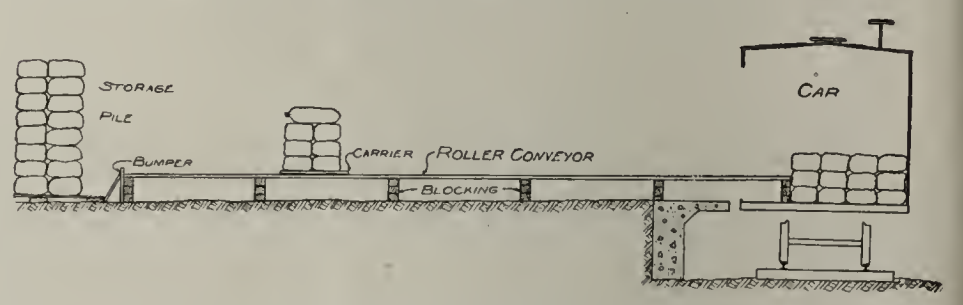
Copies can be secured by writing to the Sandusky Cement Co., Dept. T. 5, Cleveland, Ohio.

ROLLER CONVEYORS FOR HANDLING CEMENT

It is often the case that a large saving in the handling of cement on a job or in a warehouse can be accomplished by a few lengths of roller conveyors. They are made in straight units and curved units, making 45° and 90° bends. The conveyor is made up of a set of rollers, about 2½ inches in diameter spaced very closely with the axles of the rollers fastened to longitudinal pieces of strap iron about ⅜ inch by 1½ inches. The rollers are mounted on ball bearings and revolve

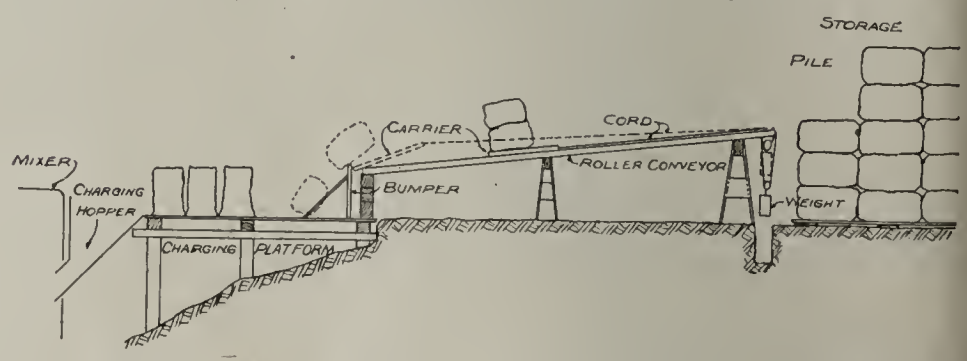
very easily. The units are about 8 feet long and 14 inches wide. They are substantially built and even when supported at the ends only will carry safely a large weight at the center. For unloading cement and brick or tile the closest spacing should be used.

The units are fastened together very simply with a couple of bolts or spikes. The curved units are so built that anything rolling over them will take the corner without help and will not jump off.



Sketch A—Unloading from Cars.

By making small board carriers, of a couple of boards cleated together, about 15 inches wide and 30 inches long, they can be very successfully used for the handling of cement in bags as has been done on numerous jobs. On account of the very free motion



Sketch B—Moving Cement from Storage Pile to Mixer.

of the rollers only a very slight inclination is needed to have carriers work by gravity alone. When it is impossible to obtain the slope required to have the cement move by its own weight, still much time and

labor is saved by having a man push the carrier loaded, compared to carrying by hand or moving in wheelbarrows.

This method can be used in moving the cement from the car to the storage pile and then again from the storage pile to the mixer.

Sketch "A" shows a scheme of unloading from cars, on an actual job. Cement came in on a siding in the building, and the pile was from 40 to 75 feet from the cars. The total slope was only a few inches, but by giving the loaded carrier a push it went the entire distance without trouble. Several carriers were used, one man bringing back the empty ones from the cement pile to the cars. One end of the conveyor ran well into the car door and was raised about 18 inches from the car floor. The end at the storage pile was also raised about 18 inches to avoid lifting from the ground. The size of the gang depended upon the number needed to remove the cement from the conveyor and stack it on the storage pile. About eight bags were loaded on the carrier at one time. By this method 800 bags could be unloaded from the car, moved 50 feet and piled by 32 hours of labor.

Sketch "B" shows a scheme used for moving cement from the storage pile to the mouth of the mixer. This method was also used on an actual job. The conveyor had a good slope and was comparatively short. One end of the conveyor was a few feet from the hopper and at that end a bumper was built that would just catch the carrier. A single carrier was used and loaded with two bags at a time. A cord was fastened to the carrier running back over the conveyor and connected to a weight. When the carrier was loaded a catch holding it was released and gravity started the carrier rolling for the mixing platform. On hitting the bumper the carrier would tip over as shown by the dotted lines and the two bags would slide off at the feet of the man charging the mixer. Relieved of its load of cement, the weight on the cord quickly brought the carrier back to the man at the storage pile. By this arrangement only one man was needed at the storage pile except when the conveyor was to be moved.

For the convenience of those wishing to investigate the possibilities of roller conveyors we are listing below firms that manufacture these conveyors:

Jeffrey Mfg. Co., 914 North Fourth St., Columbus, O.
Olson Mfg. Co., 2418 Bloomingdale Ave., Chicago.

BOSS HIGH SPEED REMIXING ACTION

An extraordinary pamphlet has been issued recently by the American Cement Machinery Co., showing the construction and specifications of their light weight steel type Boss mixer. This booklet is very attractively made up and shows their various types and sizes of mixers in detail.

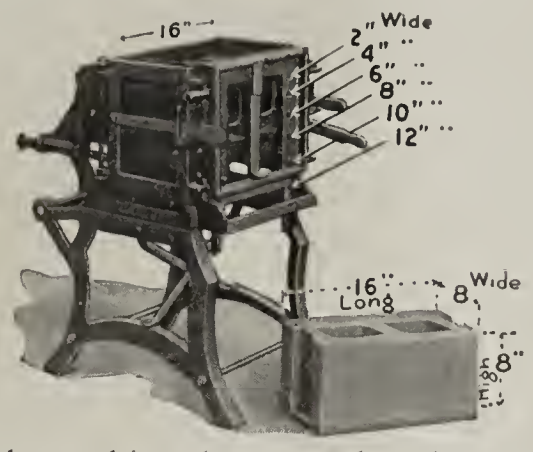
One of the pages is devoted to a description of the mixing action of the machine. Each deep scoop lifts the mass of concrete up high and then throws it down with a whirling motion, forcing the concrete away from the sides and into the center of the drum. The makers say that the discharge is very fast and a batch can be discharged in 10 to 15 seconds. This is due to the fact that the discharge spoon extends nearly two-thirds of the way through the drum and all the scoops discharge into it.

The mixer has been very successfully used in mixing lime and cement mortar, stucco, wood fibre, etc.

Copies of this bulletin with the complete specifications and illustrations of their mixers can be obtained by writing to the American Cement Machinery Co., Inc., 9635 Johnson Street, Keokuk, Iowa. A copy of these specifications should be on every contractor's desk.

MONARCH BLOCK MACHINE

For fifteen years the Monarch block machine has been one of the leaders and is now in operation in a great many of the modern and up-to-date plants. There is a big demand for concrete blocks made on



the Monarch machine, because they have clean, clear-cut face designs; because every block is of exact proportions, and because they meet the requirements of a high-class building unit at a price within the reach of every builder. The Monarch machine turns out a high-class product in shortest time at low cost, which is the reason why plants using the Monarch machine are so successful. Note the wide range of adjustments. The Monarch machine is a face down type which permits of using waterproofing or a little richer mixture for the facing at a slight additional cost. The cores provide for approximately 33⅓% air space. The blocks use a 4:1 mixture and have been tested by the United States Department of Agriculture at better than 2,200 pounds crushing strength. Silo blocks can also be made in any diameter by a few adjustments of plates. Write for circular. Republic Iron Works, Box 454, Tecumseh, Mich.

SUCCESSFUL IN DRAIN TILE PLANT IN FIRST YEAR'S OPERATION

One of the prosperous firms in Canada in the business of manufacturing cement drain tile, concrete sewer pipe, concrete building blocks, concrete brick and ornamental work is that of Joy & Son, Napanee, Ontario. They write us as follows: "We started to manufacture concrete brick, block and tile in 1910, under an open shed, but have since put up a building 60'x80'. We made tile with hand machines, until we got them introduced. The farmers were skeptical of them at first, but we finally got them to using them in preference to clay tile; in fact, the clay tile yard closed after the first year, and has not made any since. We installed a Dunn power tile machine, manufactured by W. E. Dunn Mfg. Co., 414 24th street, Holland, Mich., which gave good satisfaction, and which we are still using for the smaller sizes, using a Besser machine for the larger sizes. We use electric power and cure with steam. We find ready sale for all we make."

MILLIONS IN SAND AND GRAVEL

According to the Geological Survey, Department of the Interior, the United States produced 76,603,303 short tons of sand and gravel, valued at $23,121,617, during the year.

EQUIPPED WITH A WAGON LOADER

Mr. E. L. Bates, manager, the Sherman Sand and Gravel Company, Stevens Point, Wis., advises us he has purchased a 50-ton storage bin equipped with a bucket elevator to carry sand so it can be loaded in a wagon or a car. The machinery is driven by a six horsepower gasoline engine. This equipment is known as the Eclipse Portable Stone Unloader and is manufactured by the Galion Iron Works & Mfg. Co., 124 East Main street, Galion, Ohio.

NEW OKLAHOMA CEMENT MILL

The Choctaw Portland Cement Company have completed their new plant at Hartshorne, Oklahoma, and are in full operation.

This company owns 172½ acres of cement land having adjacent deposits of shale and stone, the stone ledge being about 150 feet thick without overburden.

The buildings and machinery are as follows:

Office and laboratory, 24x30 feet, two-story frame building with cement plaster on expanded metal, and metal shingle roof.

Main building, 112x308 feet, steel frame with metal roof, concrete walls and floors, divided into five rooms or departments as follows:

(a) Dryer room, with two 6x60 dryers, No. 3 hammer mill, six raw storage bins 13½x28 feet, elevators, conveyors, motors, etc.

(b) Raw grinding department, with 7x9 ball tube mill, two storage bins 15x12; 8x26 tube mill, storage bin 23x20.

(c) Kiln room, with two 8x110 rotary kilns; two 400 H. P. tubular boilers to utilize the waste heat.

(d) Clinker storage of reinforced concrete 44x44 feet, and 60-ton plaster storage.

(e) Finishing department, with Giant Griffin mills, cement storage and packing house, 60 feet wide, 140 feet long, 25 feet high; reinforced concrete and corrugated steel roof. Packing room 15x140 feet.

The power plant consists of two 300 H. P. tubular boilers, two 800 H. P. condensers, one 300 H. P. engine-driven exciter with 300 H. P. condenser, with feed water heater and two 750 K. W. turbines.

Machine shop building 40x100 feet, 20 feet to the eaves, metal roof, concrete walls and floor, containing 40-inch boring mill, emery grinders, machine shop saw, key seater, 18-inch by 12-foot planer, bolt mill, pipe machine, etc.

Blacksmith shop, 40x20 feet, and storage room 40x40 feet.

Crushing plant consists of No. 8 Gyratory and Symons 36-inch disc crushers.

Mr. C. L. Carman, the eminent consulting engineer, commenting on the location of the Choctaw Portland Cement Works, says: "During the last fourteen years I have been actively associated with the Portland cement industry in the Lehigh Valley district, the region of the Great Lakes, in the Rocky Mountain states and the Pacific coast, and have been enabled to make a study of the condition governing the success of Portland cement enterprises.

"I believe the geographical location of this property to be one of the few remaining points at which the business of manufacturing Portland cement may, at this time, be profitably conducted, as the Choctaw company will have a market to absorb the entire output of the plant within a territory sufficiently protected from undue competition by a favorable freight differential."

The most of the drilling is done by well drills. The rock is loaded with a steam shovel into 6-yard dump cars and taken to the crusher by a locomotive. The crushed rock is carried by a tram-road over the railroad tracks to the raw building. Bins for loading ballast and commercial rock are built directly over the railroad tracks.

Water is derived from the city lake of 160 acres, 200 yards from the plant. Coal is secured from the coal mine on the cement company's track, one-half mile distant from the plant. The bulk of the crushed stone is delivered to the Chicago, Rock Island & Pacific Railroad Company, with which company the cement company has a contract, and it will require probably two years to fill same. The cement plant is so arranged that the material passes from one department to another with very little elevating and conveying machinery. All the machinery is driven by individual motors.

Wm. B. Scaife & Sons Co. Works, Covering 14 Acres, Oakmont, Pa., Where the Scaife and We-Fu-Go Systems of Water Softening and Purifying Are Manufactured.

SCAIFE WATER PURIFICATION

"Water Purification for All Purposes" is the title of a catalog issued by Wm. B. Saife & Sons Co., 221 First Ave., Pittsburgh, in which is illustrated the various types of water softening and purifying apparatus manufactured by the company, and contains discussions of water purification as applied to various industrial uses. The catalog also includes analyses from various water supplies throughout the United States and miscellaneous data for calculating water requirements for various uses, with a large number of illustrations showing installations of water-purifying equipment. The catalog will be sent by the company to anyone requesting it.

ATLAS CEMENT COMPANY FURNISHES STERILIZED WATER TO EMPLOYES

The Atlas Portland Cement Company, at its plant at Hannibal, Mo., is supplying filtered, refrigerated, sterilized river water to its employes by means of a supply system recently installed which, it is said, operates with less expense than the old system of supplying the workmen with cold water in barrels. The sterilizing apparatus is known as a Ruv sterilizer, employing the ultra violet ray, produced by a special mercury vapor lamp, sending its rays into the water through a quartz tube. The refrigerating plant consists of a 7½-in. two-cylinder vertical, single-acting, enclosed self-oiling 12-ton York ammonia compressor, driven by a variable speed 20 H. P. motor and a Shipley double-pipe flooded condenser. Cooling tank contains 1,200′ of 1¼-in. pipe in expansion coil. Besides refrigerating the drinking water the plant freezes 600 lbs. of ice daily for use around the plant. The 12,000′ of pipe through which the water is circulated is broken up into loops to which the refrigerated water is pumped to the fountain. Most of the pipe is 3′ under ground. The

Atlas Portland Cement Co., Hannibal, Mo. We-Fu-Go System. Water Softening and Purifying, Installed by Wm. B. Scaife & Sons Co., Pittsburgh, Pa.

longest loop contains about 5,000′ of pipe. Fifteen hundred gals. of water are circulated per hr., leaving the pump at an average temperature of 40° F. and returning to the cooling tank at a temperature fluctuating betwen 50° F. and 55° F.

NEW DULUTH CEMENT MILL OPERATING

The Universal Portland cement plant at Duluth, Minn., is now working at three-fourths of its total capacity. During the last week the third burner kiln was put into operation, giving the plant a capacity of 3,000 barrels of cement daily.

The plant is now giving employment to between 350 and 400 men. A few of these are employed in completing the construction of the plant, but the majority are men who will be employed regularly in the manufacture of the plant's product.

It is expected that within two weeks the fourth and last burner kiln will be completed and put into operation. This will bring the plant up to its capacity of production, 4,000 barrels daily. Dust collectors are being installed for the smokestacks of the kilns at a cost of approximately $50,000.

The Universal Portland Cement Company will also install the Cottrell electrical precipitation process dust collecting apparatus in their mill at Buffington, Ind. They have just closed a contract with the Western Precipitation Company of Los Angeles, Calif., who control this process.

PROPERTIES OF THE CALCIUM SILICATES AND CALCIUM ALUMINATE OCCURRING IN PORTLAND CEMENT

It has been shown comparatively recently that the constituents of Portland cement of normal composition and normal burning are tricalcium silicate, dicalcium silicate and tricalcium aluminate. The present investigation was undertaken to show what part each of these played in developing the physical properties of this material. By the use of small amounts of boracic acid and chromium oxide as "mineralizers," the two silicates were prepared in a fair condition of purity and in amounts large enough to permit of the making of neat and standard sand mortar test pieces. These test pieces were broken over a period of one year. The rate of setting and of hydrating was also studied, the latter both chemicaly and microscopically. The results show that the aluminate sets and hydrates almost immediately on the addition of water, but never attains a strength much over 100 pounds per square inch; the dicalcium silicate takes several days for setting and at the end of one year contains but 5.5 per cent water of hydration. It has practically no strength at seven days, but at the end of one year has a tensile strength of 600 pounds per square inch. The tricalcium silicate has all the properties of Portland cement, both in regard to setting and attaining strength.

Mixtures of either silicate with the aluminate and with the aluminate and plaster, and of both silicates with the aluminate and with the aluminate and plaster, were also studied. The effect of the aluminate was more marked on the setting properties, as was also the case with the plaster additions; the effect of either of these two additions on the strength of either silicate or a mixture of the two was not very striking, in general not materialy changing the strength of the silicate.

Copies of this report, Technologic Paper No. 78, will be ready for distribution in a few days and may be obtained without charge upon application to the Bureau of Standards, Washington, D. C.

UNIVERSAL CEMENT COMPANY APPOINTS ADOLPH G. CARLSON CHIEF ENGINEER

Adolph G. Carlson is appointed Chief Engineer of the Universal Portland Cement Company. Mr. Carlson was formerly assistant superintendent of the Syracuse, Ind., plant of the Sandusky Portland Cement Co. He has had to do with the designing of No. 3, 4 and 6 mills of the Universal Portland Cement Co. at Buffington, Ind., and No. 5 mill at Pittsburgh, and No. 7 mill at Duluth. He was appointed mechanical engineer in 1907.

M. S. Humphryes, formerly superintendent, mill No. 6, Buffington, Ind., plant of the Universal Portland Cement Co., is appointed assistant mechanical engineer at the general offices in Chicago.

Nels Nelson, formerly superintendent Mill No. 2, at South Chicago, which plant has been dismantled, is appointed superintendent Mill No. 6, Buffington, Ind., plant.

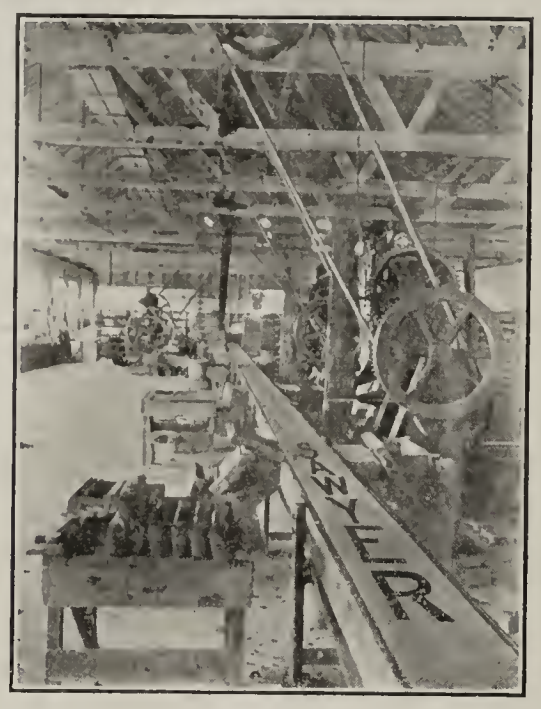
J. H. Lendi is appointed electrical engineer at the general offices in Chicago. Mr. Lendi has been connected with the company for several years in the engineering department.

A. C. Wilby is appointed assistant to president, having been assigned to those duties in April, 1915, after seven years connection with the sales department of the company, first as salesman, later as division sales manager.

SAWYER BELTING AND SOME OF ITS USES

It doesn't seem possible that any manufacturer of belting could exercise greater care in the manufacture of its product than does the Sawyer Belting Company of Cleveland, Ohio.

There is no doubt that this is responsible, to a great degree, for the prestige earned and enjoyed by this belting amongst a host of other makes, and the enthusiasm with which it is received by the consumer.



Sawyer Stitched Canvas Belt in Brick Plant.

A reputation for making a quality product is not acquired by accident, nor is it based on guess-work methods, but rather by a process of elimination and construction—eliminating that which is found faulty, and constructing along lines that are safe and sure—and such has been the growth and life of the Sawyer Belting Company.

It wouldn't be possible for this Stitched Canvas Belting to withstand so successfully the ravages of time and constant use in its various applications if it weren't for this extreme care that dominates its manufacture from

Sawyer Stitched Canvas Belt for Power Transmission.

the time they specify how the cotton duck shall be made through the various stages of folding, stitching, waterproofing, calendering and stretching, to the time they place on it the trade mark that is known the world over as a standard of quality.

No product of a manufacturer is greater than his ideals. Possibly that accounts for the enviable reputation enjoyed by Sawyer Belting Company. They have always been ambitious to put their product beyond the point where it is merely a belt, to the place where they can point to it as a leader, and know that the place will be retained as long as the quality is maintained.

There are three pictures on this page, covering a number of different places in which Sawyer Stitched Canvas Belting has proven the claims of the manufacturer. Take a brick plant, for instance. Everyone familiar with the service demanded and the conditions to be found in such a plant, will readily understand that only a first-class canvas belt can come up to specifications.

Then there's the Sawyer elevating sand. The large construction company who operates this belt realizes the economy of conveying heavy materials by means of Stitched Canvas Belting. This is only one of a number they have placed in commission. All Sawyer, too.

Another instance of service that is more than satisfactory is the Sawyer used in a machine shop. This belt has seen a number of years hard usage, and in addition to that, has rubbed against itself constantly while in operation.

A very large saw mill uses a number of Sawyer Stitched Canvas Belts to good advantage. The belts are giving satisfaction, they are running day after day, turning out lumber at the rate of one hundred and fifty thousand feet every ten hours.

Sawyer Stitched Canvas Belt Conveying Cement; 20-Inch, 8-Ply Belt Conveying a Ton a Minute.

Here's a conveyor proposition. A nine hundred foot belt carrying cement. Just think of a 20-inch, 8-ply belt conveying a ton a minute! Four of these belts used by the same company. No firm is going to order such an equipment without thoroughly investigating the article And so it goes, all down the line, whatever the belting requirements, Sawyer meets the situation fairly and squarely. In cement plants, steel mills, saw mills—as main drives from motors, bucket elevators in gravel pits, coal conveyors, sand conveyors, and many hundred other uses.

BOOKLET CONCERNING EXPLOSIVES

E. I. duPont de Nemours & Co., Wilmington, Delaware, have sent a booklet describing their various products, of which there are more than 200, classified as high explosives, low explosives, black blasting powder, sporting powders, explosives for military uses, chemicals, blasting supplies, fabrikoid, pyralin, nitre cake and a dozen or two miscellaneous and by-products. The products suitable for each of some 200 classes of customers are separately listed for their benefit. The booklet is bound in fabrikoid, which is an excellent substitute for leather for this and many other purposes.

REINFORCED-CONCRETE TOWER TANK 172 FEET HIGH

By G. A. SAMPSON
Of Weston & Sampson, Consulting Engineers, Boston, Mass.

The aim of this paper is to present the main features of the design and construction of the Middleboro (Mass.) tower tank, the largest elevated water tank in the United States and the first to be built with a hemispherical bottom.

A hollow cylindrical tower was adopted in preference to a number of columns because, structurally, it semed a safer type of support, would probably be more economical to construct, and could be designed to present a more pleasing appearance. The simple cylinder is relieved by twelve 4x24-in. pilasters. The thickness of the tower wall between pilasters is 10 in. and the greatest compression due to the dead load is 483 lb. per square inch, increased by wind pressure to 631 lb.

The 500,000-gal. tank is 41 ft. in inside diameter and has a depth of water at the center of 59 ft. The bottom is a hemispherical bowl hung at its rim from the wall of the tower. The bowl itself has a capacity of 125,000 gal. The advantages of this type of bottom over the flat beam and slab construction often employed for small tanks, and the dome type used in a few structures of considerable size, are great enough to warrant careful consideration in the design of elevated concrete tanks. As compared with the dome bottom, there is a saving of 34 per cent in the height of the vertical wall of the tank for the same capacity, or a 47 per cent increase in capacity for the same height of wall. It has a practically self-cleaning bottom. There is a better distribution of stresses because the enormous thrust in the dome bottom, which is concentrated at the most critical point of the tank, is replaced by a uniform tensile stress.

The vertical wall of the tank varies in thickness from 10 in. at the top to 16 in. at the bottom, and the hemispherical bottom from 18 in. at its connection with the tank walls to 14 in. at its center. Without any assistance from the steel reinforcement, the tensile stress in the concrete is about 250 lb. per square inch. The tensile stress in the steel acting independently is approximately 14,000 lb. per square inch. With both materials acting in conjunction, the computed stresses are 215 and 2150 lb. respectively. The tank is covered

Hemispherical Bottom Well Reinforced

to guard against the growth of algae and to prevent freezing. The roof is a concrete dome 4 in. thick, with a rise of 4 ft. in the center.

Special Joints in Tank

To insure watertight construction joints in the tank, there was cast in the old concrete a continuous triangular groove, about 1½ in. deep, running around the wall near its center subsequently filled with grout and concrete; to still further minimize the chance of leakage at each horizontal joint, an uncoated steel plate or dam of No. 14 gage metal 10 in. wide, turned over 1 in. at each edge to form a channel and bolted together to form a continuous watertight stop, was imbedded 4 in. into the old work, thus leaving 4 in. extending up for a bond with the new concrete. The cost of twelve channel rings in place was about $400.

Water was let into the tank on Oct. 24, 1915, and the depth gradually increased to 26 ft., when three hair-cracks developed radiating from the central 16-in. inlet main and extending 6 to 9 ft. therefrom. The water was drawn off, and a circular reinforced-concrete ring 9 in. thick, bonded to the old bottom by roughening, grouting and dowelling, was cast on the inside of the tank around the pipe. The structure was put into service on Jan. 1, 1916, and although the present depth of water is only about 30 ft., no weakness or leakage has developed. The sole reason for the cracks was undoubtedly the insufficient reinforcement in the design, and does not reflect on the type of bottom or the workmanship of the contractors.

The vertical wall of the tank, with the exception of three or four small damp spots in one horizontal joint where an excessively hot day caused shrinkage cracks in the top of the ring poured on the previous day, has been absolutely tight, as well as the hemispherical bottom, except for the above-mentioned cracks.

The total cost of the completed structure, including engineering, was $27,500. The average cost of concrete per cubic yard, excluding reinforcement, was $18.09; the average cost including reinforcement was $21.60. The contractor was the Hennebique Construction Company, of New York. Thomas M. Dorsey was resident engineer for the writer, under whose direction the work was designed and constructed.

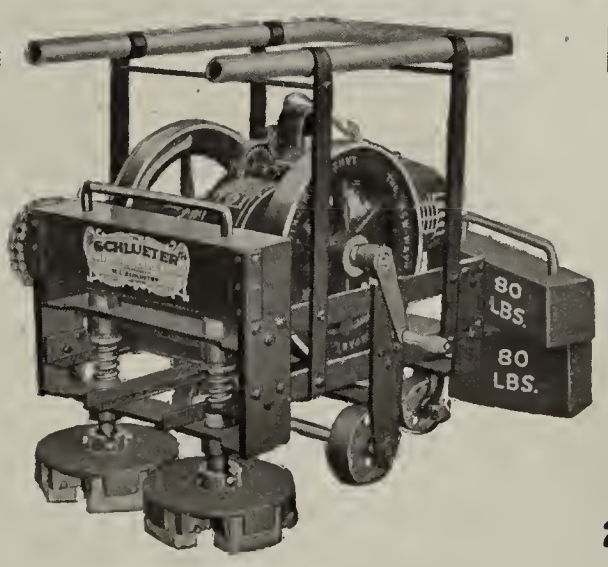
MICA FOR CONCRETE WORK

Macamima, prepared by the Crawford Mica Co., of Crawford, Nebr., is a coarsely ground mica used in the manufacture of concrete facing material; mixed with other minerals it is used to give the effect of natural rock, and it may be used for different decorative purposes.

Micolith, prepared by the Texas Mica Co., of Pecos, Tex., is another similar product used to give the effects of natural rock to concrete facings.

TEST AND TRY BEFORE YOU BUY—THE
Schlueter Rapid Floor Surfacer

The Schlueter BALL BEARING electric floor surfacing machines for mosaic, marble, composition and wood floors are the most simple constructed machines on the market. Direct chain drive AUTOMATIC DUST COLLECTORS.



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OVER 5,000 IN USE ALL OVER THE WORLD

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M. L. SCHLUETER CO.

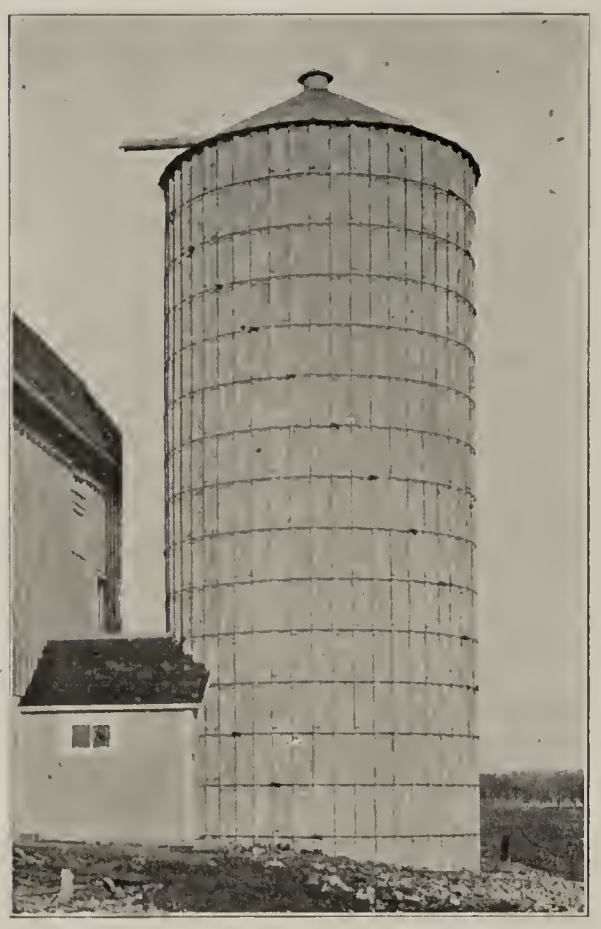
225 W. Illinois St., CHICAGO

MONEY IN STAVE SILOS.

The illustration here shown is that of a stave silo on a farm near New Hampton, Iowa. It is a type of silo which is proving efficient in service as well as a money-maker for the contractor.

The staves can be made inside at odd times or when it is impossible to do outside work, thus helping materially to save on the overhead expenses of an organization. With the staves already made a contractor is then in a position to erect the structure when an opportunity for building arrives.

The staves that were used in making the silo in the illustration are particularly adapted for this purpose. They are a wet mix stave and are made of a 1:2:3 mix



of cement, sand and gravel. The stave stands in the mold for twenty-four hours and will be ready for use in from eight to ten days after the forms are removed. The makers say that the wet mix gives a compact, uniform concrete that will be impervious to water or to the silage juices that are formed in the silo.

The form of the staves is such that the joints between the staves can be readily mortared up and when the silo is finished every joint will be sealed airtight.

Contractors who desire further information on this lucrative branch of the business should correspond with the Co-operative Concrete Construction Co., Oskaloosa, Iowa, and mention Cement & Engineering News when writing.

CONCRETE BUILDING BLOCKS

By the use of 2 parts ground white marble or white sand and 1 part Medusa Waterproofed White Portland Cement (manufactured by the Sandusky Cement Company, Cleveland, Ohio), effects can be produced in concrete blocks which give them the appearance of solid blocks of white marble. This mixture should be used in the face of the blocks, about ¾ of an inch thick.

It is important that blocks be kept moist for a period of from three to four weeks.

TO TRAIN YOUNG MEN FOR THE WORK OF CONCRETE FOREMEN AND CONTRACTORS

Wentworth Institute, Boston, is about to add to its courses of instruction one on practical concrete work, having for its object the training of young men for the work of concrete foremen and contractors. The Institute has set aside one of its best laboratory rooms for this concrete course and is fitting it up with modern testing machinery and other necessary equipment to make possible various determinations that will illustrate the technical as well as the practical sides of the applications of concrete. The first sessions will begin Monday, September 18.

This work has been made possible largely by the cooperation of the Portland Cement Association, the work having been planned by its Extension Division. J. C. Donaldson, Field Engineer of the Extension Division, will be located at Wentworth Institute for some time, assisting in the necessary preliminaries and afterward in starting and directing the course along the lines planned. A number of prominent engineers have lent considerable encouragement to this joint move on the part of the Portland Cement Association and Wentworth Institute, which gives added assurance of its success.

This departure is, in a sense, new for an institution of the class in which Wentworth Institute may justly be placed, yet is only an extension of the Manual Training in Concrete idea which has demonstrated its popularity and appeal in numerous ways during the past year or more—perhaps most notably in the recent Short Course in Concrete for Manual Training and Vocational Teachers, which was held during the early part of the summer at Lewis Institute, Chicago.

SCREENS FOR MODERN CRUSHING PLANTS

The severe service and large capacities required of screening units in the crushing plants of today demand screens of unusual size and of unusually heavy construction. The standard No. 9 revolving screen, built for such service, by the Jeffrey Mfg. Co., is one of the largest and heaviest manufactured.

The screen is formed of cast iron ends, securely connected by heavy angle iron bars to which the screen plates are bolted. This construction eliminates the use of spiders or any internal obstructions and gives a free passage through the screen.

At the discharge end, the large driving gear is attached to the supporting ring and may be renewed; at the receiving end the main casting is turned and fitted with a renewable forged steel tire. This steel tire wil out-wear any chilled casting and the tire and the bevel gear which are subjected to the greatest wear, may be easily removed and renewed without disturbing the large castings.

The large bearing supporting the discharge end is cast integral with the countershaft bearings, giving a

Sand and Gravel Plant Showing Jeffrey Belt Conveyer and Revolving Screen.

perfect alignment and adjustment of the screen at all times. This main bearing is extra heavy and is provided with a renewable thrust button of tool steel which receives the end thrust of the screen.

Standard sizes are 42 and 48 in. diameter and 10 to 24 ft. long.

The Jeffrey Mfg. Co., 914 North Fourth Street, Columbus, O., will be glad to specify the proper screen to meet any conditions and to quote accordingly.

LANSING FIVE

—Rotary Pump
—Side Loader
—Ideal or Novo Engine
—Gear Driven
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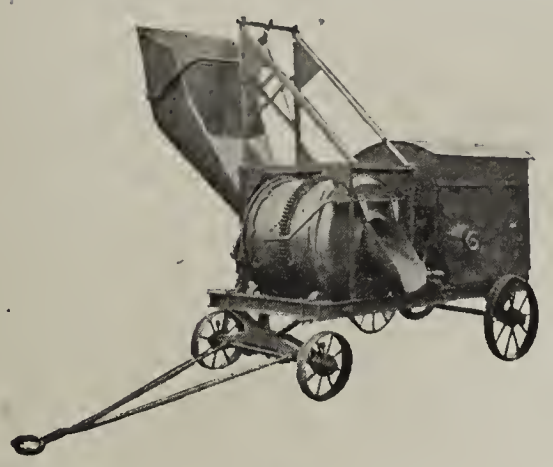

—Silo Hoist
—Batch Hopper
—Water Tank
—High Wheels
—Wagon Tread

THIS MIXER MUST EXCEL

It has been a positive necessity for us to make the Lansing Five the best mixer in the world at anywhere near its price. We went into the business of making mixers knowing that the field already was well filled, that many concerns were making good mixers and selling them at reasonable prices. But, backed by a great thirty-five year old concern with a paid-up capital of $1,500,000 and a world-wide reputation, we entered the field with a reputation and standard to uphold, not with a reputation and standard to create. So, obviously, we had to build a mixer which would stand head and shoulders above everything else in its class. We were forced to make the Lansing Five excel —AND IT DOES.

LANSING COMPANY
"KEEP YOUR PRODUCT ON WHEELS"

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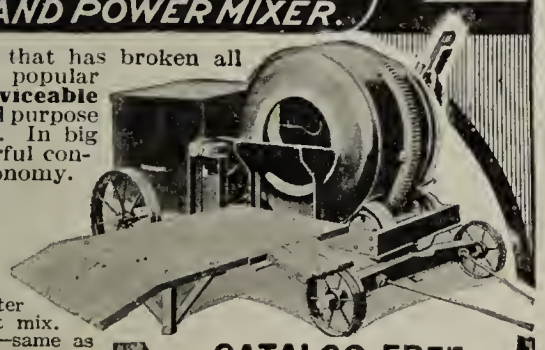
3 Machines In 1

SPEED QUALITY
Packard
HAND AND POWER MIXER.

The mixer that has broken all records—most popular and **most serviceable** light weight, general purpose mixer ever on market. In big demand for its wonderful convenience, efficiency, economy.



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Does three different kinds of mixing and gives absolute satisfaction. Mixes mortar and plaster in addition to concrete—perfect mix. High Speed "Remix" action—same as $2,000.00 pavers.

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Absolutely the lowest prices ever made on a **satisfactory** mixer, due to big volume of sales and low production cost. Packard mixers are absolutely guaranteed and sold under our "money back" trial proposition. Get our prices, terms and full information now.

CATALOG FREE
Gives you full information about all the big Packard features and shows how these wonderful little mixers will insure you bigger profits. Complete specifications on mixers and equipment; also prices, terms, etc. Write.
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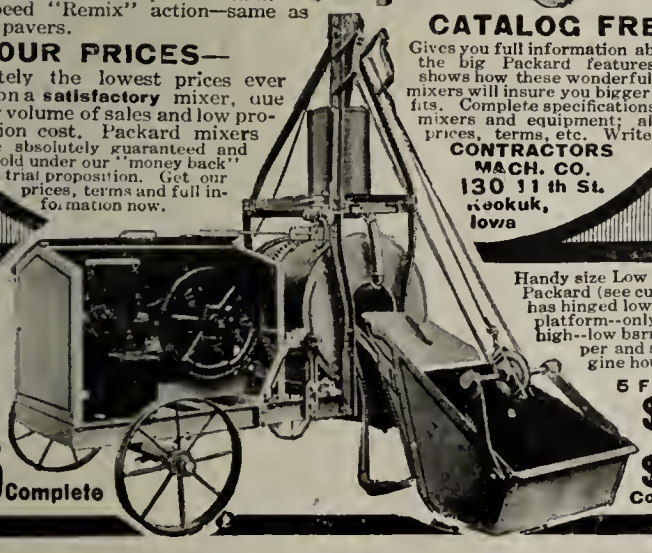
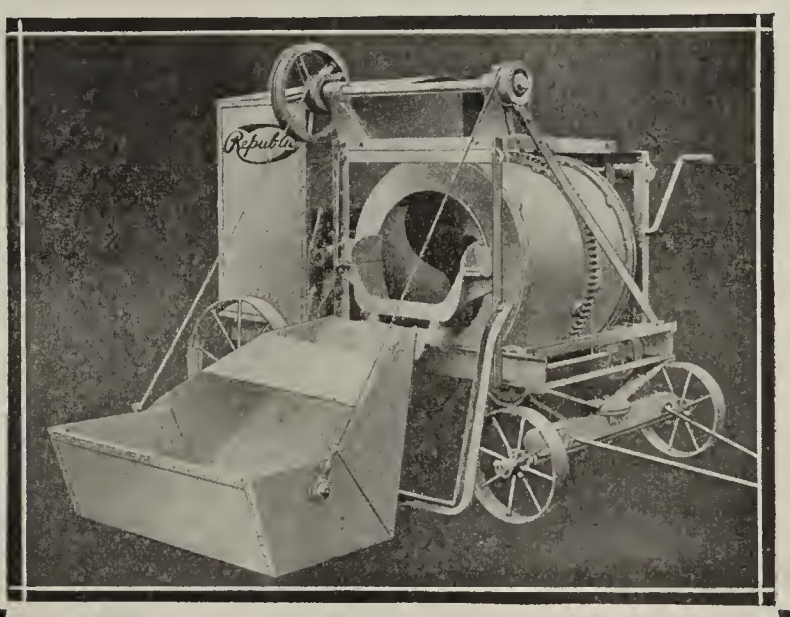


Cut at right shows Packard Mixer equipped with All Steel Power Loader--insures you 50 more batches a day.
5 Ft. Size **$290** Complete

Handy size Low Loading Packard (see cut above) has hinged low loading platform--only 20 in. high--low barrow hopper and steel engine housing.
5 Ft. Size **$185**
10 Ft. **$300** Complete



Republic Low-Charging Light-Weight Sack-Size Republic

A good, well-made 10 ft. mixer that combines LIGHTNESS and CAPACITY with STRENGTH and LOW PRICE—making it unusually handy and profitable for either large or small jobs.

Low-Charging Platform if Desired

Cash or Time—Immediate Deliveries

Many new profitable features are included in this mixer, such as big drum opening, closed discharge, big mouth skip, low overhead, automatic loader, one-man levers, high wheels, compactness, etc. For general concrete work, it can't be beat.

BATCH MIXERS, ALL SIZES, CONTINUOUS MIXERS, BLOCK MACHINES, etc.

Write us for catalogs and prices.

Republic Iron Works, Box 454 **Tecumseh, Mich.**

PORTABLE CLAM SHELL TRACTOR FOR UNLOADING CARS, DIGGING DITCHES, SEWER BACK FILLER, ETC.

The portable steel clam shell tractor illustrated on this page is manufactured by John F. Byers Machine Company, 260 Sycamore street, Ravenna, Ohio. It is a valuable machine for contractors, material yards, coal yards and industrial plants for unloading cars, digging ditches, sewer back filler, etc. Entirely one man control. Does work of twenty men. It is shipped entirely set up, boom complete and ready to work; is easily shipped from job to job by rail or street, as its size comes entirely within railroad and highway clearances and within all city and county overhead clearances. Will travel most any place a motor truck will go. Spots cars by means of winch head. All operations by power; bucket control, boom swing and peaking, two way traction, large traction wheels, adjustable folding outriggers, etc.

Byers Portable Steel Clam Shell Tractor.

CONCRETE SEWERS AND SWIMMING POOLS

Two of the latest publications giving reliable information as to the utilization and merits of concrete in special construction work have been issued under the title of "Concerte Sewers," and "Concrete Swimming and Wading Pools and How to Build Them" by the Portland Cement Association, 111 West Washington street, Chicago. The booklet on "Concrete Sewers" contains many illustrations of concrete sewers under construction together with a detailed description of the method of manufacture. The booklet on "Swimming and Wading Pools" shows illustrations of both plain and elaborate construction designs with full information on how to build them. Copies of the publications may be obtained free upon request to the Portland Cement Association.

LUTEN PATENTS STAND

Early in March, 1915, a resolution was introduced in the U. S. Senate by Senator Bristow of Kansas providing for an investigation to determine whether or not the so-called Luten Patents on concrete bridges had been fraudulently issued by the Patent Office. On July 20, Senator Ollie James, chairman of the Senate committee on patents, filed with the Senate a letter from the Commissioner of Patents covering an exhaustive investigation of the matter. This action closes the incident so far as the Senate is concerned. In this instance, we note defeat for the campaign being waged against the Luten patents by some of the Western states, and which has been made up largely with no foundation in fact.

DOUBLE-LOCKING SECTIONAL CULVERTS.

There are thousands of cases where it is entirely unnecessary to make a culvert a subject of special engineering design or special construction. For such locations the ready-made concrete culvert, a culvert which is cast in sections and assembled in place in any length desired, will be gladly welcomed. Such a culvert is the invention of the Keystone Culvert Company, Red Lodge, Montana.

These culverts are made in sections 18 inches long and double-locking in such a way, as shown in the illustration on this page, as to keep them permanently together, without metal fastenings of any sort, giving the finished culvert the strength of a monolith.

These sections are molded in a very cleverly designed collapsible form, by the wet-mix process, five sections, of 7½ feet of culvert being molded at one time, and the ends or wings, being direct opposites in form, are molded simultaneously.

The result of the Keystone Culvert Company's labor seems to be the solution of the permanent highway drainage question. This interlocking culvert was first tried out in the Rocky Mountains, where high cost of materials and labor, alkaline water, low temperatures and mountain stream erosion offered all difficulties possible, and some original experiments produced the present design. The Keystone Culvert Company have photographs showing these culverts being placed in running water of mountain streams and irrigation ditches, no damming or turning of water-course being necessary, and assert that any job can be entirely completed in one day by unskilled labor without blocking the roadway to traffic for an instant.

Distribution of this device is had by local manufacture under exclusive contract, thereby maintaining a standard construction and eliminating "cut-throat" competition, which has done so much damage to the concrete industry.

CONCRETE RAILROAD TIES

The U. S. Steel-Concrete Tie Co., of Milwaukee, organized about a year ago to manufacture a railroad tie of concrete and steel construction invented by L. W. Ashley, has increased its capital stock from $100,000 to $500,000. The rapid growth of the industry made the increase necessary. E. M. McVicker is president and G. E. G. Kuechle is secretary.

The headquarters of the Sisk Universal Concrete Tie Co. has been removed from Oakland to San Francisco, Cal.

Machine Shop of Elgin, Joliet & Eastern Railway, Joliet, Ill. Built of Hydro-Stone Concrete Blocks.

Hydro-Stone used in our machine shop at Joliet and our Y. M. C. A. building at Rossville, Illinois, has proven exceedingly satisfactory to us, and we would give preferences to such construction in the erection of similar buildings.
Yours truly, (Signed) A. F. BANKS, President E. J. & E. Ry. Co.

Locomotive Repair Shop Built of Concrete Blocks

In 1912 the Elgin, Joliet and Eastern Railway Company, finding themselves cramped in their locomotive repair facilities at Joliet, Ill., planned and constructed a large and thoroughly modern locomotive repair shop at that place. The shop was designed and constructed under the general direction of A. Montzheimer, chief engineer of the company.

The building, which was constructed of steel and concrete, is 150 by 575 feet in size, and serves as quarters for practically all of the locomotive repair operations centered at this point.

The footings on which the steel columns rest, as well as the foundations for the exterior concrete block walls, are of reinforced concrete, sunk to a depth of seven feet. The spread of the footings varies with the load carried by the columns; under the side walls between the columns, this dimension is three feet six inches.

The blocks, of which the walls of this building were constructed, present an interesting study in the uses of concrete and concrete blocks. They are known as Hydro-Stone, and were made on the building site by machinery and the process furnished and controlled by the Hydro-Stone Company, 259 Insurance Exchange Building, Chicago, Ill. The units are T-shaped, and lay up into a hollow two-piece wall. In the laying the joints were broken back and front alternately so that continuous air spaces both horizontal and vertical were formed, each block constituting a header and stretcher bond.

Rough, unfaced blocks were used in this instance. They are a molded unit of good, properly proportioned, wet concrette, made under very heavy pressure, resulting in a block which has great density and strength, and which is practically non-absorptive.

Longitudinally the shop is divided into three main bays, the larger of which comprises the entire east half of the building and is utilized as an erecting shop and as a boiler shop. For the latter work, a space equivalent to five of the transverse bays at the south end of the shop is set aside, the erecting shop comprising the remainder of this portion of the building. This 75-foot longitudinal is provided with three tracks, the intermediate track running the entire length of the building and permitting ingress and egress at either end. Entering the erecting shop bay from the north end only, are the two remaining tracks spaced 23 feet distant on either side of the central track. These

tracks end at the five-bay space allotted to boiler repairs. This constitutes an erecting shop laid out on the longitudinal track plan, and is notable among such shops in that pits are provided only in the intermediate track, in which there are two pits, each 110 feet in length. Between the tracks, and for practically the entire length of the erecting shop, there are provided concrete lined storage pits, 6 feet wide and 3½ feet deep, in which to deposit loose locomotive parts pending repairs to frames, boilers, etc. The storage pits are provided with removable covers, so that the continuity of the floor space is not interfered with except as parts are being deposited in or removed from the pits. The absence of unnecessary engine pits likewise adds to the advantages of unrestricted floor space.

The entire east bay of the shop, including the boiler shop, is served by two 75-ton cranes having a span of 71 feet each.

The west half of the building is divided into two bays of 40 feet and 34 feet 6 inches in width respectively. In the first of these, or the 40-foot bay, are placed the heavier machine tools for wheel, frame and boiler work. The third and last bay along the west side of the building is reserved for lighter machine work, and also furnishes space for a brass room, the foreman's office, the tool, tank and ash-pan repairs, and for the storage of boiler shop materials.

The floor of the building is of concrete, surfaced with ¾ inch layer of master builders' hardener. A four-inch strip just outside the rails of each track is filled in with asphaltum to afford a composition not susceptible to injury from contact with defective wheel treads. The roof is of cement tile in the form of 1¾-inch slabs over which is a coating of five-ply Lewis specification roofing material.

This building has been standing now almost four years, and shows no signs whatever of deterioration. The concrete blocks in the walls have greatly improved in appearance, and are very pleasing to the eye. Vines have been planted along the side walls, adding to the very pleasing effect made by the Hydro-Stone in the building itself.

The entire building is an achievement in economical and practical factory construction, exhibiting a simple and wholesome beauty which can be obtained in concrete without extra expenditure of money or especial effort along that line.

CONCRETE ROOFING TILE

The wood shingle has no equal as an agent in starting and spreading fire. Municipalities are beginning to realize this fact and to prohibit its use. In many sections at the present cost of shingles and labor the saving over incombustible roofings is so little as to make the wood shingle of doubtful economy.

European countries are leading us in the use of concrete roofing tile, very likely because the shingle is unknown abroad and would not be tolerated by European ideals of safety and permanence.

The Walter Concrete Machinery Company, Sask building, Indianapolis, Ind., has placed upon the market a machine for manufacturing concrete roofing tile. It is a very practical machine for manufacturing this ideal building material, which is fire-proof, storm-proof, water-proof, indestructible, and which can be put on more easily than shingles.

CEMENT CASKETS

The Southern Cement Casket Company, Houston, Texas, started operations recently and have turned out over 100 caskets.

The caskets are of the latest designs and processes in casket construction. The walls of the caskets are only half an inch thick and are heavily reinforced with a special woven wire, making them very strong.

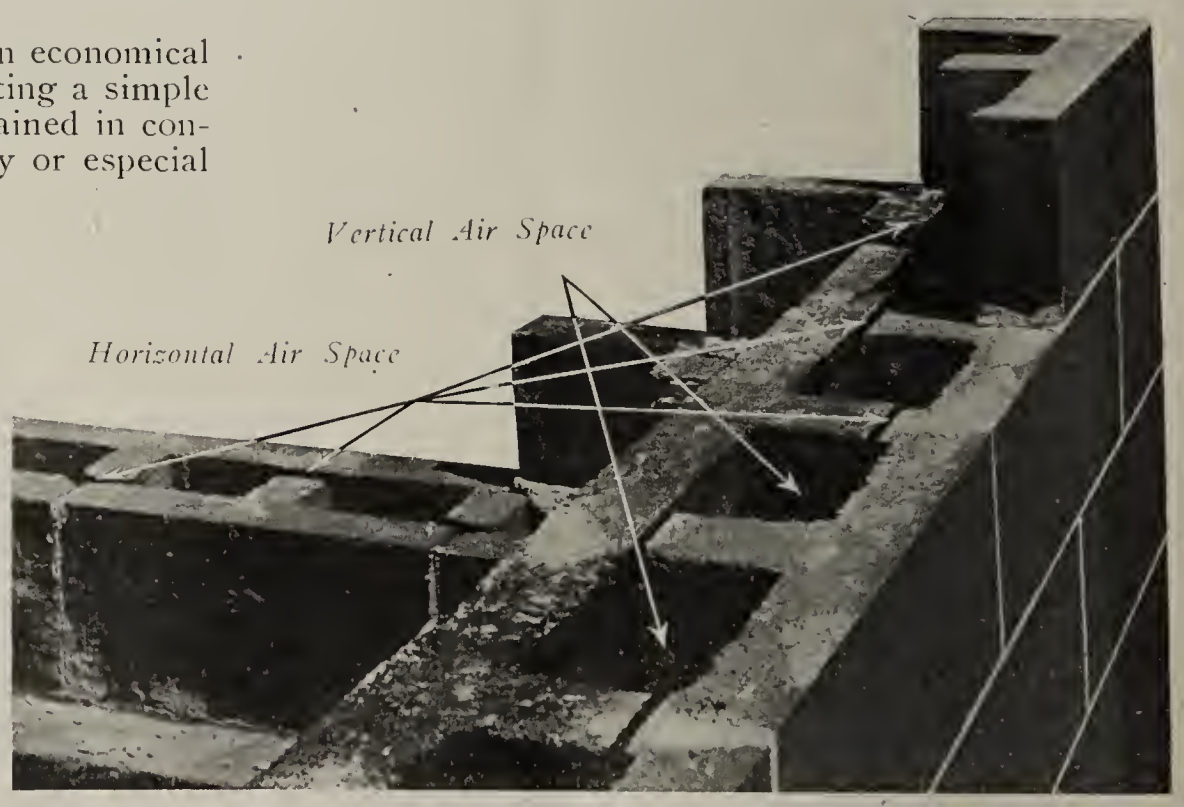
One of the features of the caskets is that they are air and water tight, and practically indestructible. They have a sealing joint between the body and the lid which, when sealed, can be submerged in water without the moisture getting into the inside of the casket. Another important feature is the modern style in which they are finished, comprising some 25 styles. The caskets are very handsomely finished with broadcloths of different shades, and some are draped along the lines of the leading wooden and metallic caskets. Another feature of the cement casket made by this company is that they are worked over and brought up to a high glaze and finished either in gold leaf or a beautiful bronze, making one of the handsomest caskets on the market.

The company has already received numerous orders for these caskets.

The Chicago Cement Burial Vault & Casket Company, 5301 Ravenswod Avenue, Chicago, are also manufacturing similar caskets.

GARY, IND., FINDS CONCRETE ALLEYS WITH INTEGRAL CURB ECONOMICAL

Concrete with integral curb for alley pavement in place of another type of pavement with separate curb has resulted in a saving of over 14 per cent to property owners of Gary, Ind. A letter from the city engineer, Wm. J. Fulton, states: "This pavement has proved so satisfactory both in appearance and cost that we are now constructing practically all our alleys with concrete."



Hydro-Stone Concrete Blocks.

This two-piece wall is formed by "T" shaped units, so laid that each unit forms a header and stretcher bond, producing a wall of greater lateral strength than can be had with any other unit masonry construction. It has been found that a 10-inch Hydro-Stone wall is as stiff and strong as a 17-inch solid brick wall.

The continuous horizontal and vertical air spaces between the inside and outside walls insulate against heat, moisture and frost. Plaster is applied directly to the walls without furring and lathing. This gives a solid plaster wall which does not crack or peel, lengthening the life of decorations. The inside wall blocks may also be faced and used without plaster, securing a beautiful interior effect so fitting in many types of buildings.

The Future and the Present of Concrete Pipe

With a Glimpse of the Past. By G. M. Wood, of the Cement Products Bureau, Portland Cement Assn., Chicago, Ill.

It is a matter of historical interest as well as of considerable economic importance that the development of the use of concrete in the manufacture of pipe and tile has been concurrent with the advancement made in matters affecting drainage and irrigation.

That the development is founded upon certain economic and physical conditions is obviously true, it is but necessary to consult the history of our own country to establish the fact.

We find that in the early days the pioneers and early settlers located their homes on what naturally appeared to be the most desirable sites from the viewpoint of water supply and soil fertility. In the natural order of events and as our pioneers penetrated to the then unknown westward lying lands, advantage was taken of the natural geographic features provided by nature which gave primary consideration to drainage. No one can wonder, therefore, that the gently rolling prairies were the choice selections of these hardy settlers to the exclusion of the low lying river bottom lands and swamps.

History records the hardship and the trials borne by these people in the maintaining of their homes and from isolated settlements there gradually grew into being towns and hamlets with their adjacent more thickly settled environs. The call of the west was as strong in those past years as exists today and in order to accommodate the immigration continually responding to this call recourse was made to lands less desirable from a physical standpoint. The swamps and bottom lands, though of a high degree of fertility, were inaccessible for immediate cultivation until the engineer and drainage contractor had been given the opportunity of using their efforts and skill.

It is at this point that we can begin to discern the influence of an economic condition fathering a new industry—drainage. A parallel sequence of conditions we find affecting the various arid territories of our country.

Sewer pipe and drain tile can scarcely be placed in the same general class, notwithstanding that there are certain fundamental attributes in common with both. It is neither the object nor the intention of this article to attempt to draw fine distinctions with reference to these two products but rather to treat the subject from a more liberal aspect as a vital factor in the utilization of concrete.

It is a matter of record that concrete was used in Brooklyn, New York, for sewers as early as 1861. Quoting from an article by Mr. Gustave Kaufman of Brooklyn, he states: "In 1877 when Julius W. Adams, Past President of the American Society of Engineers, was chief engineer of the city of Brooklyn, a proposal was made that the use of earthenware pipe should be resumed. This proposal was adversely reported upon by Mr. Adams.

The following is quoted from Mr. Adams' report made in 1877, "Last winter there were careful inspections made of our pipe sewers. In one sub-division the grades of certain streets are over two and one-half to the one hundred and an especial examination was made of the pipe in this subdivision. There is no sign of disintegration nor wearing away of the cement pipe. These pipes have been laid over five years. On the 25th of March, 1873, this department took up a cement pipe that had been laid in Fleet street in the year of 1861 and the pipe was found in every particular as good as when laid. The fact remains, however, that the renewals of sewer pipe in Brooklyn, on account of breakage or collapse, have been relatively less in the case of concrete than in that of earthenware pipe."

Up to 1890, concrete sewer pipe in Brooklyn were made by hand with its attendant difficulties of securing a homogeneous product and one of equal density throughout.

There was introduced in 1890 a machine made pipe and the resulting product fulfilled all the requirements of perfect homogenity and great density throughout. The proportions used by this company in later years consisted of one and one-half parts cement, one part sand, three parts trap rock screening containing 20% stone dust. The percentage of water used varied from ten to fifteen per cent of the entire bulk of material. This mixture when dumped on the floor was apparently dry but with a little pressure would ball in the hands.

It can be pertinently stated at this time that in Europe concrete pipe has been used for many years. Prof. Max Gary, Chief of the Royal Testing Station for Building Materials, Berlin, reports the results of some official investigations in one of his recent books, in connection with the destructive action of sewerage acids upon cement concrete pipe. From this report it is clearly indicated that there are a number of towns in Germany where the existence of concrete sewer pipe forty years of age were still efficiently performing the functions for which they were originally built.

In Paris, France, a section of concrete sewer pipe was recently placed on exhibition which had been in use about twenty years and which unmistakably shows the value of this type of material.

Returning again to our own particular development of this industry, you will find that Duluth, Minnesota, has had concrete sewers for twenty-five years. Milwaukee, Wisconsin, has used concrete sewers for thirty-five years and with a length of installation considerably greater than two hundred miles. Oshkosh, Wisconsin, has concrete sewers in excellent condition today that were laid in the 80's. Pawtucket, R. I., has ben installing concrete sewers since 1904. Time and space prohibit my detailing the many installations of concrete sewer pipe in this country.

These items are of historical interest to the cement pipe and do not include the many installations of concrete sewers of monolithic construction.

Before leaving this interesting feature of early installations of concrete sewer pipe let us look for a minute upon the first developments of concrete as a material for drain tile.

As a commercial proposition the manufacture of concrete drainage tile by machinery appears to have had its inception in 1905 at Graettinger, Iowa, where a small power actuated machine was installed and placed in operation. Cement tile, hand made by tamping damp concrete or by pouring wet concrete into molds have been found which were used at Farmer City, Illinois, in 1872, at Ames, Iowa, in 1879, and at points in Minnesota and Indiana as early as 1883.

It must not be for a moment imagined that the pres-

ent state of developments of concrete pipe machinery was in existence in the early days of this industry. The machinery manufacturer has, I believe, been giving of his time and capital generous amounts to perfect his particular machine and to meet the requirements for improvements when such improvements have been brought to his attention through the development of this industry.

There are today many efficient as well as varied types of concrete pipe and drain tile machines on the market each deserving of careful study and consideration of their manifold classifications and merits. To the prospective as well as established operator of a concrete pipe and tile plant a thorough study of his own requirements should be made before purchasing and installing new and additional plant equipment.

Of first importance is the question of power or hand operation. This is, of course, easily decided when the plant is already in operation and additional machinery is contemplated. To the man, however, preparing to establish a concrete pipe and tile plant consideration of capital available, source of materials, prospective value of territory, shipping facilities and arrangement of site must be carefully investigated and compared. From the result of such investigations can be determined the advisability and adaptability of utilizing power or hand actuated equipment. The prospective output of the plant both as relates to amount as well as variety of sizes will be a governing factor in the selection of a proper machine.

It is impractical to attempt to formulate any definite methods of procedure for the establishment of a concrete products plant. The foregoing are subjects for careful consideration and can only be given the proper value in each separate and individual proposition, their effects and values combined with sound business judgment are prime factors in the establishment of the manufacturing plant for concrete pipe and tile.

It is advisable, indeed extremely so, to inspect plants already in operation and thereby endeavor to profit by their successful operations and draw conclusions of efficient arrangement and outlay.

Were I asked what I considered the most vital and most important detail of the concrete pipe and tile industry outside of the plant arrangement and equipment, I would unhesitatingly say the manufacturing methods and process. Upon no one feature does the extension of this industry rest so completely as upon the nature and continued uniformity of the product. As in all manufacturing operations, the use to which the product is to be put will control the quantity and quality of the constituent materials.

Concrete pipe for sewer installations will be subjected to different service conditions than either irrigation pipe or drain tile. It is obvious, therefore, that this fact must be duly taken into consideration depending upon the particular product to be manufactured.

Sewer pipe, no doubt, is called upon to withstand the most severe ramifications of service. It must be impermeable, and the relatively greater depths at which it is usually imbedded under the ground surface will necessitate a somewhat stronger mixture than is customarily used in the manufacture of drain tile and irrigation pipe. The factor of sufficient strength is often given greater consideration than the question of impermeability in the making of sewer pipe. Impermeability, however, must be primarily considered for many self evident reasons and depends upon the degree to which raids in the sand and aggregate are filled with cement paste, and upon the use of the proper amount of water in mixing. The determination of these factors are by no means haphazard but lend themselves to definite scientific analysis.

During the construction of that gigantic piece of engineering built to provide New York city with its water supply the engineer, Mr. W. B. Fuller, devised and put into daily practice a method by which daily determinations were made resulting in his being permitted to construct thin water proof walls and effected a saving of many thousands of dollars. I mention this instance to prove the value, financial and otherwise, of the advisability of correctly studying the material available for the manufacturing process.

We can only hope to receive universal and favorable recognition of concrete pipe and tile when we can go before the engineer and contractor and the buying public with a product of uniform and high standard. To maintain such a standard rests individually with each and every concrete worker and tendencies to lessen the manufacturing costs at the expense of a reduced standard of quality can only result in effects harmful to an alarming degree. It is imperative, therefore, that a proper understanding of the properties of concrete is essential to its intelligent use and application.

Too much stress cannot be laid on the necessity of carefully studying and investigating the materials available for use and the utilization of them in a manner to produce a product of high standard and quality. General theories are not applicable to each individual locality and thought must be extended in the judicious and proper selection of the materials at hand in order that the manufactured product may be equal to a predetermined standard. It is the height of folly to attempt to say that the proportioning today used at Salt Lake City, Utah, in the manufacture of concrete drain tile will give equally satisfactory results if followed at Lynden, Ilinois, without first learning the nature of the material indigenous to these localities. Such theories are useful indeed when used with prudence and judgment but likely to bring remorse and anguish when employed promiscuously.

There are, however, several practical methods easily applied that will enable those using them to definitely determine the correct proportioning of the various materials entering into the manufacture of other concrete products. It is not my intention at this time to endeavor to prescribe definite proportions nor manufacturing methods. These are questions in my estimation that can only be treated individually and specifically, each problem presenting certain peculiarities of its own and requiring treatment accordingly.

The use of concrete for the monolithic construction of sewers is and has been for a long time considered the best of engineering practice. Yet we find considerable opposition developing to the use of precast cement pipe as an auxiliary to a concrete trunk line or storm sewer and for no apparent tangible reason.

Precast concrete pipe possesses many advantages over sewer pipe of other materials. It is a uniform product, true as to form, concrete pipe preserves the section upon hardening in which it was cast—it is free from warping—it permits of complete inspection tests during manufacture. It is stronger than pipe of other material, size for size. Giving good aggregate and proper proportioning the pipe is more impermeable than any vitrified pipe. On installations of sufficient magnitude the pipe may be manufactured upon the site of the work thereby eliminating transportation costs and finally permanence of construction.

These advantages are today pretty generally accepted as facts. It rests, however, within the province and ability of each and every concrete pipe and tile manufacturer to bring his product to that high degree of quality whereby the above claims for superiority may be substantiated.

I have attempted in a general way to present a few facts relating to the concrete pipe and tile industry as it exists today.

What the future of this industry means, what the future holds, no one at this time can truthfully predict. I venture the assertion without fear of being considered a prophet that this industry is on the dawn of a remarkable era. The widespread demand for drainage and its attendant benefit—the increasing activities in sanitation mean enlarged markets for pipe and tile with a product made of a material as substantial as concrete its universal use and approval can only be retarded by lack of proper appreciation on the part of the makers.

The Association which I represent realizes the wonderful possibilities of this product and its capacity. They, have appropriated a considerable sum of money to further this work and to promote the more general use and knowledge of concrete for drainage and sewerage matters. The Association wants to work with you, to help you in your problems and in turn asks your co-operation and with our combined efforts, and, I may be pardoned for my extreme optimism, can not but result in benefits of wonderful value to all.

GRANITE FACING IN SHEETS FOR CONCRETE BLOCKS

The only part of the facing material that you put into a block machine that shows on the block is the surface itself. To make a granite block you have only to provide for granite surface. Why make your facing seven or eight times as thick as you need it? You are multiplying the cost of your facing material seven or eight times when you do that, writes B. F. Gibler, Mauston, Wis.

We coat a sheet of paper. (for any size of block) with crushed granite. Place the sheet, paper side down, on the face plate, tamp in the wet backing and when the block has set, remove the paper by applying warm water. You will have a granite-face block rivaling natural stone in appearance. You reduce the cost of facing material and the cost of applying it and your block requires no finishing, as there is no cement film on the face to be etched off.

Concrete block manufacturers owning their own machine can manufacture this sheet facing in their own plant at less than ¼c per sheet, as one ton of granite costing $3.25 at Crown Point, N. Y., will face 4,500 sheet of 8x16 facing by using our process.

Cloth sheets are used for lining forms for slush work, caps, lintels, dimension stone, stucco or pebble dashing, floors, walls, etc., and full directions for making this granite cloth will be sent with every machine sold.

Write Mr. B. F. Gibler, Mauston, Wis., and mention Cement & Engineering News when writing for circular describing this method of making a high-class block at low cost. Sample sheets and prices will be sent promptly.

THE MID-WEST CEMENT SHOW

The Twelfth Annual Mid-West Cement Show and Convention of the Mid-West Cement Users' Association will be held in the Omaha Auditorium, March 6, 7, 8, 9, 10, 1917. Plans are now ready for the reservation of booths for those desiring to exhibit. Practically one-half of the spaces of the large Auditorium were reserved for this show at the close of our last year's show.

The Twelfth Annual Convention of the Mid-West Cement Users' Association will be held at the Hotel Rome during the Cement Show. Several other associations are also planning on holding their Conventions at this time, so as to enable the members to take in the Cement Show.

There will be a joint exhibit of cement companies similar to the one at our last show, but more complete and comprehensive. The exhibit will show the many uses and possibilities of concrete. Certain exhibits will be especially instructive as they will show how certain products are made and cured.

Plans are being perfected now and will be announced later which, when completed, will be the means of bringing out a large and interesting crowd during the entire Cement Show.

Firms intending to exhibit should make their reservations at once. Plats and space blanks may be obtained by communicating with the Secretary, Frank Whipperman, 28th Avenue and Sahler Street, Omaha, Neb.

HOW TO PRODUCE GRANITE FACE CONCRETE BLOCKS

If any of your readers wish to make the very highest type of concrete block, or any other flat stone, let him use the following prescription: Secure from the Medusa Cement Company, Cleveland, O., their white cement, also from Crown Point Spar Company, New York City, a quantity of their No. 4 and No. 5 Granite. Now take the form and brush on a coat of glue and immediately cover with No. 4 Granite. Let the loose particles fall off, and then cover again with a size of granite which I obtain by re-screening No. 4. Shake this off and again cover with a No. 5, which is like very fine sand. Let harden and then give a brush coat of cement and granite—and here is right where the beauty of the stone is brought out. No matter how well the form is covered with granite crystals, when the coating of cement and granite is applied it will find its way between the crevices of the crystals and show on the outside when the stone is cured.

Now, if you used just cement alone when the form was brushed, the stone when cured would have too white an appearance between the crystals. Mix white cement, one part, and No. 5 granite, which is almost as fine as cement, also one part; mix like paint, keep continually stirred up, so that the granite will not settle to the bottom of the vessel, and then apply. Now mix up a facing material of one part white cement and two parts granite, No. 4, and cover about ½ inch. Now fill in with common stuff and tamp.

In sills and large stones turn them out on a bed of sand and cover with a wet piece of muslin, doubled two or three times. Keep the muslin wet and it saves lots of time in sprinkling, and besides it will hold the moisture for a day or so. Don't use anything else but white cement in making granite faced blocks, or ornamental pieces, and you will have an article that is impossible to obtain in any other way. Large stones faced on all four sides can be made in this manner, but the operator has to use quite a little ingenuity in order to release his stones without breaking the corners.

I would be pleased to exchange samples with any of your readers who are making any kind of granite or other faced material.

Can any of your readers inform me how to make, use, and cast from glue and sand molds?

Can anyone advise me where I can obtain natural colored sands and stones suitable for facing blocks and ornamental work?

Arthur W. Boothroyd, Newburgh, N. Y.,
Maker and Builder of Plain and Ornamental Cast Stone.

CEMENT AND ENGINEERING NEWS

(PUBLISHED MONTHLY)

WILLIAM SEAFERT, Editor and Publisher

Office—672 Transportation Building, Chicago

Telephone, Harrison 5397 Cable Address, "Seaferts" Chicago

Entered at the Post Office at Chicago, as second-class matter, July 21, 1896 under Act of March 3, 1879

SUBSCRIPTION RATES:

United States, Canada, Philippine Islands and Mexico, $1.00 per year; all other countries, $1.50 per year.

DISCONTINUANCES—The greater part of our subscribers prefer NOT to have their subscriptions interrupted, in case they fail to remit promptly for renewal. It is therefore assumed, unless notification is given to the contrary, that the subscriber wishes to continue taking our paper. Therefore CEMENT & ENGINEERING NEWS will be sent until we are notified to discontinue—Such notice should be sent when the subscription expires.

Advertising copy or changes in ads. must be in this office by the 25th of each month, as hereafter our magazine will appear on the 5th of the following month

Advertising Rates Sent on Application

JOHN F. WALDRON - - - - - - - - Advertising Manager

CHICAGO, NOVEMBER, 1916

PLANS FOR NEXT ANNUAL CEMENT SHOW

The Tenth Chicago Cement Show will be held in the Coliseum Wednesday, February 7, to Thursday, February 15, 1917, inclusive.

The concentration of exhibits in the Coliseum, balcony and annex will enable visitors to inspect them conveniently. Machines and products will be closer together, thus facilitating comparison and enabling buyers to make purchases more expeditiously. However, as less space will be available for the next show than for the last, each exhibitor will be asked to apply for as little space as can accommodate his exhibit, and in this way it is hoped to make the number of disappointed applicants as small as possible.

Closing the show on Thursday will make it unnecessary for exhibitors to be away from home more than one Sunday.

There will probably be a joint exhibit of cement companies, similar to the one at the last show. The ninth show joint exhibit was considered by visitors, the building fraternity and the trade press to be the most complete and comprehensive display of the uses of concrete ever presented to the public. The exhibit was broadly educational and promotional in its scope. It interested the general public as never before in the uses and possibilities for concrete. It is planned to make the tenth show joint exhibit even more comprehensive than that of last year, and to show, to as large extent as possible, products in the making.

During the eight-day period Chicago will be the center of activity in the building material industry. The National Builders' Supply Association will hold its annual convention at the Hotel Sherman February 11 and 12, and the Illinois Lumber and Builders' Supply Dealers' Association at the same hotel February 13 and 14. While the dates have not been definitely set, it is probable that the American Pipe and Tile Association will be in session during the Cement Show. It is also likely that the American Concrete Institute will meet at the same time. Beside these organizations, it is possible that the American Association of Engineers and other similar associations will convene in Chicago during the show.

LATE PUBLICATIONS OF CEMENT ASSOCIATION

Within the last few weeks three valuable publications on concrete work of various kinds have been issued by the Portland Cement Association, namely, "Concrete Sewers," "Concrete Swimming and Wading Pools" and "How to Build Them," and permanent construction of irrigation canals is treated in a pamphlet entitled "Concrete Linings for Irrigation Canals." Photographs and sketches show work of this nature executed in Texas, Idaho, Kansas, Nevada, California and other states.

The Portland Cement Association maintains an adequate editorial bureau, which, in conjunction with other departments of the organization, secures the most complete information on topics before compiling them into booklets, and when the information is finally given to the public, readers can feel assured that their contents contain reliable information brought down to present-day facts in the most concise form. Copies may be had from the Portland Cement Association, Conway Bldg., Chicago, Ill.

EXPERIMENTAL RESEARCHES IN CONCRETE

On September 1, 1916, Lewis Institute, Chicago, and the Portland Cement Association, 111 West Washington Street, Chicago, entered into an agreement whereby they will hereafter jointly operate the Structural Materials Research Laboratory at Lewis Institute. This laboratory has, during the past two years, attained merited distinction for the work which it has done.

The Structural Materials Research Laboratory has as its object the carrying out of experimental researches in concrete, reinforced concrete and concrete materials, and to give instruction to the engineering students of Lewis Institute on the properties of concrete and other materials of construction.

CHARGES CEMENT MANUFACTURERS ILLEGALLY COMBINING

A. N. Moore, vice-president and treasurer of the Oregon Portland Cement Company, of Oswego, Ore., on August 29 filed with the United States Court in Portland a suit charging fourteen cement companies of the United States and Canada with illegally combining in violation of the Sherman and Clayton anti-trust acts, alleging that they sought to restrict the production in his plant to one-sixth its capacity and to dictate the exact territory in which he may do business, and that the prices maintained cause the coast states to pay more than a million dollars annually in excess of what they should pay.

CO-OPERATIVE PLAN TO ASSIST RURAL CONCRETE CONTRACTORS

Rural contractors specializing in concrete work, especially those building silos and other farm structures, also contractors or others who would like to specialize on such work, will be interested in knowing of a co-operative plan now being carried out by the Extension Division of the Portland Cement Association.

Anyone interested in concrete contracting work or in taking up such work, is urged to address a letter to the Director, Extension Division, Portland Cement Association, 111 West Washington Street, Chicago, for some information that will prove valuable, and that can be obtained without cost or other obligation.

*Permanent Farm Building Construction**

BY PROF. M. H. HOFFMAN

Agricultural Department, Iowa State College, Ames, Iowa.

Fellow Cement Workers: I want to say this morning that it gives me a great deal of pleasure to be here today. I believe that I can be classed as a cement worker, although in our work at the State College we have to look into various kinds of construction, but I am particularly interested in the same kind of construction that you are interested in, for I believe that the time is not far distant when we are not going to be able to get lumber, and we will have to look to concrete as one of the building materials for the farms. Concrete and clay tile and that sort of thing is going to be the building of the future, there is no doubt about that.

I see that the program committee has assigned to me the subject, "Permanent Farm Buildings," but I don't know that I shall confine myself entirely to concrete buildings, but may talk about other construction work on the farm as well. I believe that the farms of this state, our state and the states adjoining you here should be a good field of operation for concrete men, for I believe the time is coming when the farmers will have to look to you men to build their houses and barns and silos, and the question of permanency now is a big one with the farmers. In the old days when our fathers came across the states and settled upon the farms, they bought cheap lumber and built cheap houses and barns, and when the land increased in value they sold out and went on and settled upon more land and built other cheap buildings, but the time for temporary buildings upon the farms of these states of the middle west is passed. Permanent buildings is now the problem that concerns the farmers. Permanent buildings are going up today on the farms of these states, and will continue to go up, and you men who are in the concrete business should reap the results.

I was talking to a big lumber man not long ago, and I asked him the question as to what per cent of the lumber that was going out on the farms now was being used to erect new buildings, and he said between 50 and 60 per cent. I asked lumber men in other counties the same question, and got the same reply. This means that from 40 to 50 per cent of the lumber sold to farmers is being used for repairs.

We find that in Iowa for the last ten years $42,000,000 per year has been spent upon farm buildings, but the pitiful part of that is that only half of that amount represents the increase in total value of buildings. Where does the other twenty-one million go? Into repairs, if you please; into the repairing of old buildings now upon the farms, or the replacing of those that have burned down. And also, I may say, into the repairing of those that have tumbled down, because they were not built of good material. So I believe the people of the state of Iowa and other states have a great deal to learn from the folks in the old countries, where they have been putting up permanent farm buildings for hundreds of years. Going back into history, we find that there were buildings erected at the time of Christ and before Christ that are still standing. In Germany, Belgium and France there are buildings that have stood for hundreds of years, and it took the big German bombs to tear them down.

I am glad to say that there is in the middle west now a decided tendency towards the construction of better farm buildings and making them of fireproof material.

Along with this kind of construction certain problems have arisen, and one of the problems that is of the greatest importance, it seems to me, is the location of the buildings. A contractor who is erecting a permanent building has to be more careful as to location than the man who is building a frame house; he should be careful first that it is placed in the right place with respect to other buildings already erected.

A farmer the other day was telling me that it takes him three hours to do his chores every night, when if he had the buildings properly arranged he could take care of them in one hour, and a difference of two hours every day is quite considerable.

I was out on a farm in one of the northwestern counties of Iowa last fall and was talking with a farmer in regard to some improvements. He was talking about the kind of silo to erect. He had some very good concrete work on his place, concrete walks and foundations and feeding floors and things of that sort, and I knew that he had on his own place a pit from which excellent gravel could be obtained, and I suggested that he build a concrete silo. His boy was there, and he spoke up and said: "No concrete silos for me. Dad is going to run this place for about three years yet, and then I am going to run it; dad thinks the silo ought to be over here, and I would place it over there, for that is where we can fill it and feed it out most conveniently, and I don't believe you can move a concrete silo, can you?"

I went into the matter of location and found that the boy was right. It is important to locate the buildings with respect to each other, so that the work can be done well and we don't want to have to move these permanent buildings. Whether we will come to the old country style of putting all the buildings under one roof, I don't know. I do know we won't have to follow the old plan of putting them far apart, so that if one building burns down, all the rest of the buildings on the farm won't go with it. Much time in getting around from one building to another can be saved by erecting fireproof buildings, because they can be so much nearer together.

Another problem is the matter of ventilation. A great deal of adverse criticism has been made of concrete construction because the buildings were damp and the walls were covered with frost in the winter time. I think that criticism well taken, but I don't believe it is the fault of the building material, but it is the fault of the method of construction of the people using it in not providing the proper ventilation.

I was in a dairy barn on one of our farms not long ago, on a well improved Iowa farm. In this barn there were sixty-seven cattle housed, in a barn not quite as big as this room, and the only ventilation they had was where a couple of window lights had been broken out. There were sixty-seven cows in that barn, and as I went in the air was so bad that it hurt my eyes. I said to the hired man, "Isn't this hard on the cows?" He said, "Yes, it is; when I take them out to water they stagger." Then I talked to the owner, and asked him about it and asked him if he was not afraid of tuberculosis, and he said, "No tuberculosis in my herd."

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*Address before eleventh annual convention of Mid-West Cement Users' Association.

Six months later I learned that he had had a tuberculin test of his herd made, and out of the sixty-seven, thirty-two reacted. That was due to the fact, I believe, that the barn was not ventilated. Not that the lack of ventilation would cause tuberculosis, but if it was present in one cow such conditions would be most favorable to its spread.

In our permanent construction with the solid walls and floors we don't have the natural ventilation that we got in the old frame barns, where the walls were full of cracks, and where open spaces under the floors let the wind whistle through and under in the winter time. I believe that is one of the things that we have to look out for in putting up this permanent construction—to make proper provision for ventilation. There are a good many patent ventilators on the market, and a good many people figure that when they have put one of these ventilators on that they have solved the whole problem, but I am not a bit sure of that. Not long ago a farmer took me out to his place to show me a concrete hog house that he had. He had one of these patent ventilators up on top of it with a board flue going down along the side wall—one of those fixed to take the air from along the floor and out through the ventilator. He complained to me about the place being so damp. He had not allowed place for the fresh air to get into the house from outside, and the ventilator could not take out any when none could get in.

I believe the same thing is true with much of our building, unless we leave a place for the air to get in, there is not going to be anything for the ventilator to take out.

Then there is the matter of drainage. Under the old form of construction there were cracks in the floor and the urine and water went down through. With concrete floors with no drainage and no outlet it stands on the floor. As soon as we put in a floor of concrete, if we don't provide for drainage, we have a wet floor; the floors will not drain and consequently we have an endless amount of dampness.

Then there should be provision made to let in plenty of sunlight. The farmer who showed me the hog house that did not have any fresh air, also had no arrangement so that it got enough sunlight. In building we ought to consider all these things. A well located building is one of the most important things. It should not be shaded too much by trees or other buildings. The windows should be made larger so that more sunlight will come in and so arranged that the sunlight will fall upon the floor and cover as much as possible of it every day.

I do not believe we should advocate the use of concrete where there is no good material available. I know there are a number of places in Iowa, and I presume also in this state, where there is no good gravel and sand. I know there are places in the northern part of the state where I go every once in a while that I notice the concrete walks and floors are pock-marked, showing that the proper material was not used in making the concrete.

In Kossuth county some time ago I went through a creamery, and there were little holes in the cement work there as big as a lead pencil and up to an inch across where the gravel in the concrete had separated from it worked out and left a hole. Last October I was giving a talk at a farmers' institute and at the close of the talk a man came around and said, "I have a gravel pit out on my place, and I want you to come out and see that and tell me what you think of it. The gravel has been used all over this part of the country for a good many years, and we think it is very good." I went out and looked at it and found that it was about half clay. The other half was mostly soft material, easily broken up, and there was very little good hard gravel in it. It was absolutely unfit for concrete work, and the walks and foundations where it had been used showed it. That is one of the things that one has to be very careful about.

Some people think that anybody can put up concrete work, but that is not the case, as you men know. A good deal of work that has been put on the farms of Iowa, and that has not been successful, was put in by the farmers themselves, and it is not right and a considerable portion of it that has been put in by experienced men is not giving satisfaction because it was put in carelessly. In these cases the failures were not due to poor cement or poor aggregate, but to poor workmanship. I have, however, found some very good work that has been put in by the farmers in part due to the help of splendid books that are gotten out on concrete construction by the various cement companies. These books and pamphlets have been of a great deal of service to the farmers.

I want to take up briefly some of the buildings that have gone up in our state.

In building barns it used to be the custom in certain sections to start with poles stuck down in the ground and build it on those, and when the poles rotted off they put a stone under that corner of the barn. A later development was to build a barn with a foundation four or five inches deep but the water came in more on one side than another and the foundation settled more on one side or end than another, and the results were sway-backed barns and barns of all conditions of decrepitude, when they ought to have stood up straight and in good shape. We have got to go down and build our foundations deeper; that has been the trouble with the tumble down barns that we used to see upon the farms—I say used to see; we see some yet, but not nearly as many as formerly. I saw a barn in the eastern part of the state the other day and the man had put in a foundation twenty inches thick, one foot below the ground and three feet above. There was a waste of a whole lot of good concrete that could have had a better and a cheaper foundation. Some- had put in a twenty-inch footing below frost and narrowed it to eight inches at the grade line, he would have been used to better advantage elsewhere. If he times we spend our money very unwisely by putting it in the wrong place.

Some of our farmers are building barns of concrete and clay blocks, and then put in a reinforced concrete haymow. If somebody happens to get careless in the haymow and there is a fire, and the haymow burns, the bottom of the barn will be left standing. Some of you men will say that the animals will be roasted alive if the haymow burns while everyone is away from the place.

Mr. Williams: They would be suffocated from smoke through doors and windows before the heat could hurt them from overhead.

Mr. Hoffman: Suppose everything was closed up?

Delegate: It would take a longer time.

Mr. Hoffman: Maybe it would give the man a chance to get home before they burned and get them out, or some neighbor would see it burning and come over and let them out. In a number of places also we are now putting on cement asbestos shingles. In looking over the fire marshal's report we find that many fires are caused by sparks from adjacent burning buildings falling on the roof and starting the fire. If these asbestos shingles are used, many fires will be avoided, as the embers falling on the roof will go out.

Taking up for a minute the matter of the hog house,

it should be so located and so built that the sunlight can come through and strike all parts of the wall and floor at some time during the day if possible. One of the newest forms is a hog house to be set north and south. The roof is constructed with a continuous skylight in it, so that the sunlight will fall on the floors and walls; the wall to be about five feet at the outside. These walls may be built of cement or clay blocks or monolithic concrete. The advantage of the continuous skylight is that, each day the entire floor is traversed by two broad bands of sunlight, except in the south end, where windows are provided. Such a hog house twenty-five feet wide by sixty feet long that will accommodate twenty sows, can be built for around $800, and it will be found to be entirely satisfactory.

There has been a good deal of discussion among farmers about the hog house floors, more than any other part of the building. A great many people believe in a dirt floor without anything under it. Some believe in a dirt floor with woven wire fencing under it, and some advocate wood floors and some solid concrete floors, and some two inches of concrete over a three-inch specially made clay block. The latter two are better than any others, in my opinion.

I was on a farm in the northeastern part of the state, where they were trying out a new experiment in hog house floor. They used ordinary field drain tile set on end and filled in and around with gravel. They thought the gravel would provide drainage and the tile would keep the hogs from rooting. Instead of having the nice floor that they thought, two weeks after the hogs had been turned in it was the dirtiest place I ever saw and absolutely unsanitary. I saw another hog house where the farmer laid one side of the floor in solid concrete and the other side in brick, thinking that the cracks between the brick would drain off the moisture. In a very short time the brick and the cracks had become clogged with manure so that the moisture no longer drained away, and in addition the floor was rough and not easily cleaned. The solid concrete floor proved much better than that.

Another criticism is that a concrete floor is cold, yet I have had men tell me that their cattle, calves and hogs would come up and lie on a concrete floor at night rather than lie outside or on the dirt. They found it warmer than the other, because it was dry and conserved the heat from the animals' bodies.

The worst part about these concrete hog houses, as I said before, is that there is not enough provision made for ventilation, and the frost gathers and melts on the under side of the roof and drops down on the floor and the urine stands on the floor and is not drained away, and that leaves the nest wet, and the wet nest or floor is always cold. I believe it is worth while if you are building a concrete floor in a hog house to put on some wooden flooring about four feet square in each pen, if you have a sow with little pigs they can lie on that. I believe a wooden floor is cold for the reason that the wind blows up under it, but if a wooden floor were flat on the ground it would be an ideal floor for hogs from the point of warmth but not from sanitation and drainage.

Many farmers are building outdoor feeding floors of concrete. These floors have many good points. They are sanitary; they can be cleaned off or the rains will wash them off. The hogs will make better gains if they pick up less dirt with their feed and less of the feed that is wasted than on a dirt floor. Also there is no better floor than one of concrete for keeping out the rats. By using concrete floors and concrete sidewalks the rats have no place to hide, and as long as they have any place to hide they are sure to be there. I believe this is one of the greatest benefits from the use of concrete in farm buildings.

(To be continued in December issue.)

WARNING

Notice is hereby given that The Medusa Concrete Waterproofing Company, a subsidiary of the Sandusky Cement Company, Cleveland, Ohio, filed suits upon the dates given against the following companies for infringement of the Medusa waterproofing patent:

Ceresit Waterproofing Co., Theodore F. Koch and Frank A. Mitchell.—June 10, 1915, in the U. S. District Court, Seventh Circuit, Northern District of Illinois, Eastern Division.

Integral Waterproofing Co., I. A. Bennet Co. and I. A. Bennet.—April 6, 1916, in the U. S. District Court, Seventh Circuit, Northern District of Illinois, Eastern Division.

The Arco Co.—June 9, 1916, in the U. S. District Court, Eastern Division, Northern District of Ohio.

All infringements will be prosecuted.

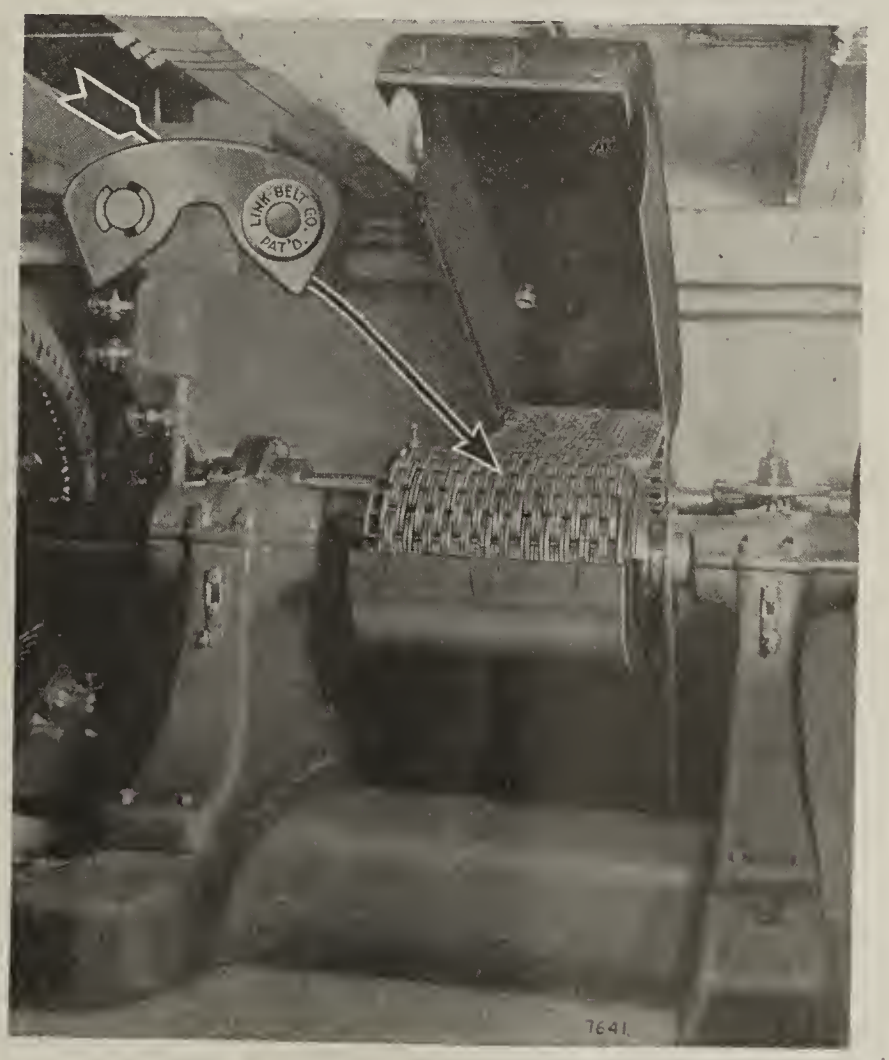
LINK-BELT SILENT CHAIN DRIVES

The Link-Belt Silent Chain is the modern method of transmitting power. From prime mover to machine, or from lineshaft to counter—wherever it is desired to transmit power without slip or loss. 98.2% efficient on actual test.

The success of the Link-Belt Silent Chain is due to the superiority of its patented Pin-Bushed-Joint construction—a round pin and two case-hardened semi-circular bushings, used in no other chain.

The important point to remember is that this patented Pin-Bushed-Joint construction limits natural wear to the case-hardened pin and to the inside surface of the case-hardened bushings—which guarantees long life and continued quiet, efficient operation.

Write for 112-page price list Data Book No. 125.



540 H. P. Encased Link-Belt Silent Chain Generator Drive.

CONCRETE BLOCK FARM STRUCTURES

The hog house shown on this page is 24x32 feet and was built by the Cement Products Construction Company, Walworth, Wis. Blocks were made of 1 part Medusa gray cement to 4 parts good coarse sand, faced with a 1 to 2 mix of Medusa cement and Medusa waterproofing manufactured by the Sandusky Cement Company, Cleveland, Ohio, and sifted sand. The manufacturers advise as follows:

"We did the construction work by the day, but for the four years we have been in the business it has averaged us about 5 cents per block to lay them. The blocks cost the owner 15 cents at the factory, making the hog house cost in round figures $200. This spring the farm changed hands and the present owner, not keeping any hogs, has turned it into a granary.

"Our block construction was so satisfactory that this year we built on the same farm two silos 14x30 feet, inside dimensions, and a dairy barn 32x76 feet, using 8x8x16-inch blocks made on the Dunn block machine with a Monarch power tamp. The silos cost $340 each, ready for roof. Medusa waterproofing was also used in the facing of these blocks."

Concrete Block Hog House, Bigfoot Prairie, Wisconsin, 24x32 Feet.

Concrete Block Silos and Dairy Barn, Bigfoot Prairie, Wisconsin.

CONCRETE TANKS FOR GASOLINE

Four reinforced concrete tanks for the storage of gasoline have recently been completed for the Queen City Oil Company at West Toronto, Ont. On account of certain city regulations, these tanks are placed below ground and completely back-filled on top. Owing to confined space, the tanks were built rectangular in form (each tank being 21 ft. 6 in. by 38 ft. long by 9 ft. 6 in. high), having total exterior dimensions of 94 ft. by 40 ft. by 6 ft. The tanks are to be filled by gravity from tank cars, and used for the distribution of gasoline.

Work was started by excavating to just above the water level in the soil. This excavation was taken out by scraper teams, the final trimming being done by benching out. A concrete mat was deposited all over the bottom of the excavation, and on this were built four tanks side by side, but independent one of the other. A tile drain surrounded by broken stone was placed around at the bottom and on the outside of the walls. This drained into two sumps, one on each side at the center of the four tanks. Square reinforcing steel was used throughout, and the concrete was of a rich, dense mixture. The walls and floor were poured continuously, so as to do away with any bonding of old and new concrete, the gang working as late into the night as was necessary to complete each tank.

To economize time the forms of two tanks were set up at one time; and after these had been poured and the concrete sufficiently set, the forms were stripped off, and set up again for the remaining two. After the walls had hardened sufficiently, the roof and its supporting columns were placed, and the slab poured. The manholes were left in the roof of each of the tanks. These are to be used for the intake and discharge pipes, and also for the cleaning-out of the tanks. At the completion of the work, a water test under a maximum head was made on each tank. These tests showed the tanks to be perfectly tight.

CONCRETE BLOCKS OF REAL MERIT

The Auburn Novelty Works, Auburn, Indiana, manufacturers of all kinds of cement products, write as follows: "We have all the concrete building block trade for miles around this city, and put up nearly 100 buildings in the last seven years. We have grown from the output of one hand machine to the capacity of 1,200 blocks per day, besides all our other lines of concrete products. We use Dunn block machines."

Concrete Block and Stucco Residence of George Campbell, Auburn, Indiana.

All the blocks and stucco work in the residence of George Campbell are of Medusa white cement, and the entire house was made free from moisture by the use of Medusa waterproofing, permitting the interior plastering to be applied directly to the block wall without furring or lathing, the use of Medusa waterproofing lowering rather than increasing the expense to the owner.

Concrete Block Residence of Isaac Grogg, Auburn, Indiana.

The residence of Isaac Grogg was the first white cement block job put up by the Auburn Novelty Works. In the manufacture of concrete blocks they use one part Medusa white cement with Medusa waterproofing added, 2½ parts white sand, and hydrated lime.

CEMENT PRICES IN OREGON

Four bids for furnishing the city of Portland, Oregon, with cement for the next three months were considered by the council and while three of them were identical, the contract was awarded to the Columbia Digger Company, which handles cement from the plant at Oswego, Oregon—the Oregon Portland Cement Company. The price asked by all four companies was $2.30 a barrel, but the Columbia Digger Company and two others offered a discount of 5 cents a barrel, provided the bills were paid within 10 days after delivery.

CONCRETE ROOFING TILE

The Walter Concretile Machinery Company, Indianapolis, plans to establish a plant in Fremont, Ohio, for the manufacture of concrete roofing tiles. It is stated that the company will occupy quarters in the present plant of the Fremont Waterproofing Company. The Twin City Concretile Company of Minneapolis has in operation a plant for manufacturing concrete roofing tile.

Types and Costs of Slack Cable Excavator Plants

BY A. A. SMOCK

Mansfield Engineering Company, Indianapolis, Ind.

A few years ago the slack cable method of excavation was not well known, and was used only in a few isolated places. Lately, there have appeared on the market, however, a number of excavators employing this principle, and the idea is becoming more popular. This type of excavator consists of four essential parts: (1) The bucket (2) the cable upon which the bucket is hung, (3) the mast, to the top of which the slack cable leads, (4) the engine that controls the operation of the outfit. There are numerous buckets for this use, each designed under some special patent and possessing features that distinguish it from others.

The excavators may be used for soil stripping, handling of coal, ore, rock, or other loose material, and especially for gravel excavation. The increased amount of concrete work in the last few years, together with the popularity of the gravel road or "pike," has caused a great demand for sand and gravel. This was formerly supplied in two ways, first, and most primitive, by driving a wagon to the nearest open pit and loading it by hand; second, by railroad shipments from source of supply to the nearest sidetrack, where it could be unloaded and hauled to the work. The latter method was and still is expensive on account of freight rates, and the former method is becoming less common because these neighborhood pits are gradually being excavated down to the ever-present water, from below which it cannot be removed by hand.

Naturally, the upper layers of gravel above the water are more or less dirty, while that below the water is cleaner when removed. The slack cable excavator can easily remove this gravel from almost any depth and therein lies one of its chief advantages.

The operation of the outfit is very simple, and is under the control of one man. The bucket is brought in by a "drag" cable on the front drum of the hoist, and the track cable is made loose or tight as desired by a "tension" cable, which passes over a pair of double blocks, increasing the pulling power of the engine about five times, which is sufficient to tighten the track cable until the bucket is raised clear off the ground. The bucket is drawn in to the dumping point, at which there is generally some device attached to the track cable, causing the bucket to discharge its load, after which it is released, rolling down the tight cable by gravity. The cable is then loosened, allowing the bucket to rest on the ground in its natural digging position ready to repeat the operation.

The power must come from some kind of a double drum hoist, either steam or electric. The most popular size is the one-yard bucket, which is generally operated by an ordinary contractor's double-cylinder, double-drum hoist, size 8x10, although smaller engines will suffice in easy digging. If electric power is used, the best hoist is a direct-connected one with a system of gears enabling the bucket to be drawn in slowly with great power while loading, and then to be drawn up to the dumping point more rapidly with less power. In this case, a 50-horse-power, variable-speed motor is sufficient. In occasional plants where electricity is low in cost, the bucket is sometimes operated by means of a hoist which is belt connected to a 60 to 70-horse-power motor, the larger size being required on account of the loss due to belt slippage, and also on account of the motor running at a constant speed.

The average time required to make a complete trip with the bucket is found to vary a great deal, on account of the difference in the material, the speed of the engine, and the skill of the operator. The average outfit uses the ordinary hoist engine, which has a speed of about 200 feet per minute. Thus, on a 400-foot span, 2 minutes are required to haul in the bucket and about 1 minute to dump it and return it ready for another load—3 minutes per trip. This will be found to be a very conservative figure, for many plants run as high as 40 trips per hour. Much time can be saved by using a two-speed hoist, arranged to

By means of this equipment gravel is obtained from the far side of river. Mansfield Engineering Company's "Pioneer" back dump bucket and excavating outfit at Casper, Wyoming.

run at about 150 feet per minute under a heavy pull, and at about 450 feet per minute under a lighter pull, thus bringing in the bucket in 1 minute instead of 2, and enabling the operator to get out 30 buckets per hour under similar conditions.

The commonest form of gravel plant is the "bar run" outfit. This consists merely of the bucket, cables, mast and engine, digging the gravel from a pit or creek-bed and depositing it on the ground in a pile. Many such outfits are in use in various locations, and are generally called "gavel dippers," the owners as a rule making a business of "dipping" gravel for townships, road supervisors, contractors or private individuals.

In or near cities where strict specifications are enforced regarding the gravel used, it is customary to erect screening plants to wash the sand and gravel thoroughly and grade it into sizes. These plants present an interesting study, but it is not our purpose to enter here into a discussion of their details of design and construction. There are many kinds of screening outfits, the simplest kind having an elevated table upon which the gravel is dumped, and from which it is washed by a stream of water through an inclined trough, in its course passing over inclined screens that give the required separation. The most complex plants with the greatest output and most efficient operation are more expensive, being equipped with revolving screens, washing tanks, crushers, overhead bins, etc. Between these two limits there are endless varieties of screening outfits.

COST.

The following estimates of the cost of plants are based upon new material throughout, although in actual practice much second-hand but serviceable material is used, such as old lumber, second-hand cables, and engines. The "bar run" outfit, with a one-yard bucket, costs, complete, including a reasonable allowance for freight, erection, etc., about $2,250.00, while a screening plant of the more simple type, including a water pump and the screen towers, will be about $3,000.00, which is subject to increase on account of bins, crushers, etc., to sometimes as high as $10,000.00

OPERATING COST.

The average bar run outfit, with a one-yard bucket, can easily excavate, with the ordinary engine and engineer of average ability, 250 yards per 10-hour day, often running much higher or lower according to conditions. Many plants hire only one man, who tends to his own boiler, as well as making all minor repairs. It is economy, however, where results are desired, to employ an engineer, fireman and a laborer. The daily costs will be as follows:

Engineer	$4.00
Fireman	2.50
Laborer	2.00
Coal	3.00
Oil and miscellaneous	1.50
Total	$13.00

The yearly fixed or overhead charges are ordinarily not computed, but should be for an accurate notion of the business. They are as follows:

Interest on $2,250.00 at 6 per cent.	$135.00
Renewal of cables, blocks and sheaves	400.00
Depreciation of engine	200.00
Depreciation of bucket	150.00
Total	$885.00

The depreciation items are as a rule replaced by the actual money spent on repairing the outfit.

Counting out Sundays and days when no work is done on account of weather, it is safe to figure a year at 200 days.

200x$13.00 daily pay roll, etc.	$2,600.00
Annual charge as above	885.00
Total	$3,485.00
200x250 yards	50,000 cu. yd.
Total cost per yard	7 cents

As an actual matter of fact, the cost at most plants is much more than this. Sometimes the men are paid yearly, whether they work or not. Frequently there is not enough business available, so that, instead of operating steadily and excavating 50,000 yards, 20,000 or 30,000 yards will be the year's business, costing 12 to 17 cents per yard.

SCREENING PLANTS.

These plants require more careful operation, and as they are generally dependent upon the retail trade near cities and towns, the output is determined not so much by the capacity of the plant as by the amount of sales made. The daily expense is greater, on account of the attention necessary to keep the screens clean, operate the pump, dispose of boulders, etc., as well as the necessity of maintaining some sort of an office and a set of accounts. In view of these facts, the above figures will be modified as follows:

200x$15.00	$3,000.00
Annual charge	1,000.00
Accounts and collections	1,000.00
Total	$5,000.00
Annual sales, average	30,000 yards
Cost per yard, screened gravel	16⅔ cents

This figure is very conservative and can be attained by proper management of a plant. At the customary retail prices of 35 cents per yard, a profit of $5,500.00 per year results. As most plants are managed by the owner, this sum represents his salary and profits for the year.

A large plant, with a capacity and a demand for 400 yards per day, running at full capacity, will put out screened gravel for as low as 10 cents per yard, and is a very profitable business.

WYOMING GRAVEL PLANT

By installing a Pioneer dump bucket drag line cableway excavating outfit, manufactured by the Mansfield Engineering Co., tenth floor, Fletcher Bldg., Indianapolis, Ind., Mills & Baker of Casper, Wyoming, save hauling gravel a distance of two miles.

Dumping in bin from which wagons are loaded. Mills & Baker gravel plant, Casper, Wyoming.

This installation crosses the North River at Casper and scoops up gravel from the north side and dumps it in a hopper on the south side of the river. As this gravel bed is a mile from the nearest river crossing, this long haul is eliminated.

The plant consists of a 1 cu. yd. bucket operated by 1,100 ft. of 5/8-in. diameter wire rope over 584 ft. of 1 1/8-in. diameter wire rope, furnished by A. Leschen & Sons Rope Co., St. Louis, Mo.

A round trip of the bucket is made in about two and one-half minutes, and only two men—an engineer and fireman—are required.

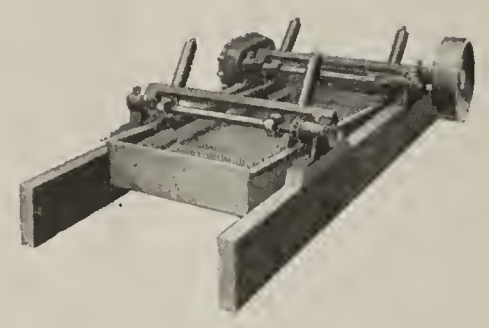
PULSATING SCREEN

The Symons pulsating screen shown herewith is manufactured by Chalmers & Williams, 1452 Arnold street, Chicago Heights, Ill., and the price is one-half first cost of a revolving screen. Other special features to consider are as follows:

Size—Occupies ½ space of a revolving screen.

Low cost covering—Being about ⅓ the cost of a revolving screen.

Covering easily replaced—Taking about ⅓ the time of revolving screen.



Area of screen surface always working against only one-sixth of the area whch is always working in a revolving screen.

Motion does not wear out the screen plates as fast as the slipping, grinding action in a revolving screen.

Steps make this screen a system of screens.

Small amount of power used.

Snappy motion eliminates blinding.

Write Chalmers & Williams and tell them what you want to screen, size of material and capacity wanted.

REDUCING QUARRYING COSTS

By S. R. Russell

We have been urging quarrymen for some time, in the pages of this magazine, and otherwise, to use explosives containing less nitroglycerin than the straight or gelatin grades. Our reasons are that it is possible for them to save money in their blasting operations besides helping us to conserve a commodity, the supply of which is steadily getting less. Explosives of the type of Red Cross Extra or Monobel Powder are admirably adapted to many quarry operations. Those who previously would consider nothing but "straight" or gelatin dynamite for their blasting work have had their eyes opened to the merits of these explosives after a trial.

The blast made recently at the quarry of the Colorado Portland Cement Co., Portland, Col., with Monobel No. 6 shows that excellent results can be obtained with this explosive in quarry work.

The quarry face at Portland is from 39 feet to 49 feet high. The stone consists of homogeneous layers of limestone varying in thickness from 6 to 28 inches and separated by thin layers of shale also varying from nothing up to 6 or 8 inches thick. The stratification is flat and the quarry floor practically level.

Holes were drilled with a Keystone cable drill, size O, driven with a 15 hp. variable speed electric motor, using a 5 5/8-inch diameter bit. Each hole was drilled two feet below the quarry floor level.

The blast consisted of 44 holes, arranged in four rows. Holes were spaced 20 feet apart and the first row consisting of 15 holes was set 20 feet back from the face, with 18 feet between the rear rows. From 265 to 425 pounds of Monobel No. 6 were loaded per hole. Each hole was primed with two No. 7 Du Pont electric blasting caps. One set of detonators was connected in series and the other set in parallel and all fired by means of a 220-volt D. C. power current. Sand was used for tamping.

The results of the blast were very satisfactory, both as to economy and fragmentation as is evidenced by a letter from Mr. Frank D. Walters, superintendent of the plant, part of which we quote.

"The shot was without doubt most successful. The charge of powder in the first row was figured for 2¼ cubic yards of stone per pound. This was done in view of there not being any burden in front at the bottom from previous shot as steam shovel in the last cut through had cleaned up. Holes in the rear rows were loaded for 2 cubic yards per pound of explosive. This in view of obtaining a better shattering effect from the rear rows, as experience has shown that in order to get desired fragmentation when two or more rows of holes are fired simultaneously, rear row holes must be more heavily loaded, as they must contain sufficient powder to heave up and shatter the material rather than push it out."

The following summary gives in detail the cost of preparing and firing the whole blast:

Number of holes		44
Spacing average		20 ft.
Burden average		20.6 ft.
Depth average		45 ft.
Tons of rock broken		61,182
Cubic yards		30,213
Cost of drilling (labor)	$	261.89
Cost of drilling (power)		24.00
Total cost of drilling	$	285.89
Total feet of hole		2,094
Cost per ft. of hole (drilling)	$	.1317
Cost per ton of rock (drilling)		.0064
Charge of powder per hole		265 lbs. to 425 lbs.
Amount of Mon. powder in shot		14,850 lbs.
Amount of Giant powder in shot		100 lbs.
Cost of 44-42 ft. fuses @ $0.1848	$	8.13
Cost of 9-36 ft. fuses @ $0.1632		1.47
Cost of 42-24 ft. fuses @ $0.1200		5.04
Cost of Mon. @ $0.125, including freight		1,826.25
Cost of Giant @ $0.115, including freight		11.50
Cost of shot (powder and fuse)		1,852,39
Cost of shot (drilling and loading)		325.64
Total cost of shot	$	2,178.03
Cost per ton of rock (powder and fuse)	$	.0302
Cost per ton of rock (drilling)		.0046
Cost per ton of rock (loading)		.0006
Total cost per ton of rock	$	.0354
Number ft. of powder in all holes		1,294
Number pounds of powder in shot		14,850
Number of pounds of powder per ft. of hole from 5 5/8" bit		12.25

Amount of rock broken per pound of powder: 4.0 tons, 2.03 yds.

SOUTH AFRICA'S CEMENT INDUSTRY

We understand that the Pretoria Cement Co., Ltd., which, as stated in a recent issue, is the most important of the South African cement companies, its production being well over 400,000 casks per annum, are now busy erecting another large factory in the Marico district, near Mafeking. All the important machinery has already been delivered, and it is expected the company will be producing there about the middle of the year.

The limestone deposit at Marico, which is to supply the new works, has been known for years, is unique in its way for South Africa, and is of enormous extent. The material is found in a decomposed state—i.e., as a fine powdered chalk, and will require practically no grinding in its preparation for the kiln. Suitable clay is found in abundance on the property, thus furnishing all raw materials required for manufacturing a first-class Portland cement. The water supply is being obtained from bore-holes, which have been proved to provide over 100 per cent in excess of immediate requirements. The company's cement has established a reputation for uniformity and general excellence of quality second to none, with the result, as already stated, that it is now being extensively used throughout the country in every class of work, notwithstanding that the demand has raised the price by 2s. per bag. The Union Government has for several years been using it in their harbor works, notably Durban and Cape Town, where enormous quantities are being absorbed in the dock improvements, while the Government of the Province of Mozambique is also employing the cement in its harbor works at Lourenco Marques. It sells at about fifty per cent of the cost of the imported article in the interior, and also shows quite an appreciable margin of saving even at the coast. This confirms our view that English and other cements have had their day in South Africa, especially now that the Union Government has given an assurance to those colonial manufacturers that all its supplies of cement will be purchased from South African producers during and after the war if the present standard is maintained and the price is reasonable.—The British and South African Export Gazette (London).

NEW EDITION HENDRICKS' COMMERCIAL REGISTER

The twenty-fifth annual edition of Hendricks' Commercial Register of the United States for Buyers and Sellers, which has just been issued, rounds out a quarter of a century of usefulness by this standard publication. The work is especially devoted to the interests of the Architectural, Contracting, Electrical, Engineering, Hardware, Iron, Mechanical, Mill, Mining, Quarrying, Railroad, Steel and kindred industries, containing about 350,000 names and addresses, with upward of 45,000 business classifications. Full lists are included of producers, manufacturers, dealers and consumers, listing all products from the new material to the finished article, together with the concerns handling these products, from the producer to the consumer.

There are 1,512 pages of text matter and the index and contents numbers 149 pages covering over 50,000 trade references. The list of Trade Names, Brands, Titles of Identification, etc., is published for the first time and numbers 202 pages. This list furnishes ready reference for purchasing agents and prospective buyers to distinctive products manufactured by firms listed in the work.

JEFFREY MFG. CO. OPENS AGENCY IN KANSAS CITY

The Jeffrey Manufacturing Company of Columbus, Ohio, have opened an agency with the Gustin-Bacon Manufacturing Co., a large and old established firm of Kansas City, in order to establish closer cooperation with their customers in Kansas, Missouri and Oklahoma, and improve their service there.

The Gustin-Bacon Company will carry a line of Jeffrey transmission machinery, chains, buckets, etc., in stock. Mr. J. S. Davidson, who has spent several years in the sales and engineering departments of the Jeffrey Company, has associated himself with the Gustin-Bacon Company and will handle all inquiries for Jeffrey products. His experience and training in the application of these products will enable him to be of great assistance to customers in solving their problems in elevating, conveying and transmission machinery, also crushing, pulverizing and screening equipment.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912,

Of Cement & Engineering News, published monthly at 672 Transportation Bldg., Chicago, Ill., for October, 1916.

State of Illinois, County of Cook, ss.

Before me, a Notary Public in and for the State and county aforesaid, personally appeared J. F. Waldron, who, having been duly sworn according to law, deposes and says that he is the Business Manager of the Cement & Engineering News, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Wm. Seafert, 672 Transportation Bldg., Chicago, Ill.; Editor, Wm. Seafert, 672 Transportation Bldg., Chicago, Ill.; Managing Editor, Dr. W. Michaelis, 672 Transportation Bldg., Chicago, Ill.; Business Managers, J. F. Waldron and F. Jamieson, 672 Transportation Bldg., Chicago, Ill.

2. That the owners are: (Give names and addresses of individual owners, or, if a corporation, give its name and the names and addresses of stockholders owning or holding 1 per cent or more of the total amount of stock.) Wm. Seafert, sole owner, 672 Transportation Bldg., Chicago.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is ———. (This information is required from daily publications only.)

J. F. WALDRON.

Sworn to and subscribed before me this 26th day of September, 1916.

(Seal.) Charles W. Anderson.

(My commission expires July 25, 1918.)

A MOST WONDERFUL LUBRICANT FOR PULVERIZERS, CRUSHERS, DROP HANGERS, ETC.

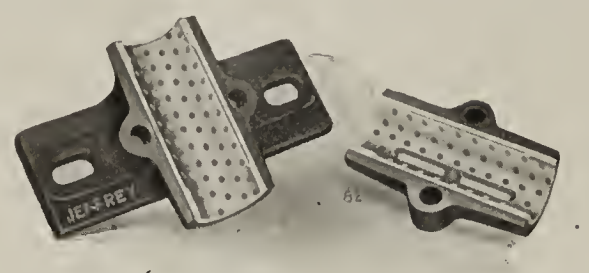
The highest engineering and mechanical authorities agree that graphite is the best existing lubricant, and every man who is familiar with bearing troubles knows its value.

It is, in fact, generally recognized as the true lubricant, but to apply it and retain it in the bearings has presented a difficult problem.

Scientific and mechanical authorities have invested fortunes and spent years of time and study in an endeavor to blend graphite with metals, but absolutely without success. The problem of utilizing the wonderful lubricating qualities of graphite, however, has been solved, but in an entirely different manner.

By a simple, patented, mechanical device graphite is combined with babbitt metal, achieving results far superior to those obtainable with any other method of lubrication.

With this device in the bearings high speed machines have been run for months at a time without a drop of oil, hot boxes have become unknown, and all bearing troubles have been completely eliminated.



Randall Graphite Lubricator—A Remedy for Bearing Troubles.

This simple, ingenious device, known as Randall Graphite Sheet Lubricator, consists of a series of solidified graphite cones, slightly tapered and attached by hydraulic pressure to a fine copper wire screen or fabric. The cones are pure graphite.

This lubricator device is applied when the box is babbitted. It is bound with twine or soft copper wire so that the graphite cones are held tight against the shaft or mandrel, and the babbitt metal is poured in the usual way. In this manner the metal flows and sets around the cones, making them a part of the bearing, and thus you have what is practically a self-lubri-

cating bearing, as it only requires 10 to 25 per cent of the oil or grease otherwise used.

Randall Graphite Lubricator is a positive remedy for all bearing troubles. It is the one and only means by which heating of the bearings can be entirely overcome.

There would seem to be no need to tell cement, lime, gravel and crushed stone producers of the advantages to be gained by the use of this lubricator in their plants. It has been used for more than a dozen years in some of the largest cement and rock crushing plants in America, and any of them that have ever started to use it will never willingly do without it again.

One of California's largest manufacturers has been a user of it for a long period, and some time ago its president had this to say:

"We have been using the Randall Graphite Sheet Lubricator in our plant for two years and find it is a great oil saver and does away with hot boxes entirely. We are replacing all brass sleeves that give out with the Graphite Sheet Lubricator and Babbitt Metal."

Every cement, rock, lime and concrete plant manager would serve the interest of his company best by finding out about this remarkable lubricator, which is sold under a guarantee of "satisfaction or money refunded." It comes packed one dozen sheets in a box, and each sheet contains 144 square inches. It is manufactured and sold by Randall Graphite Sheet Lubricator Company, 816 West Lake street, Chicago, Illinois.

TWO NEW CONCRETE MIXERS

Two drum concrete mixers which have been accorded a very favorable reception by contractors and builders have been placed on the market by the Municipal Engineering & Contracting Company, 21-D Railway Exchange Building, Chicago, Ill. They are known as the No. 0 and No. 1, and have respective capacities of 4½ and 6 cubic feet of mixed material, the quantities being based according to the wet batch rating of the National Association of Mixer Manufacturers. The construction throughout is steel riveted steel plates and shapes, with the exception of the racks and gears. All operations are controlled from a single position, connections both fixed and operating being of simple and strong construction. The company states that no sacrifice of strength and durability has been made in any part. The charging arrangement consists of a hinged funnel-shaped steel plate hopper which, when lowered, can be filled from the

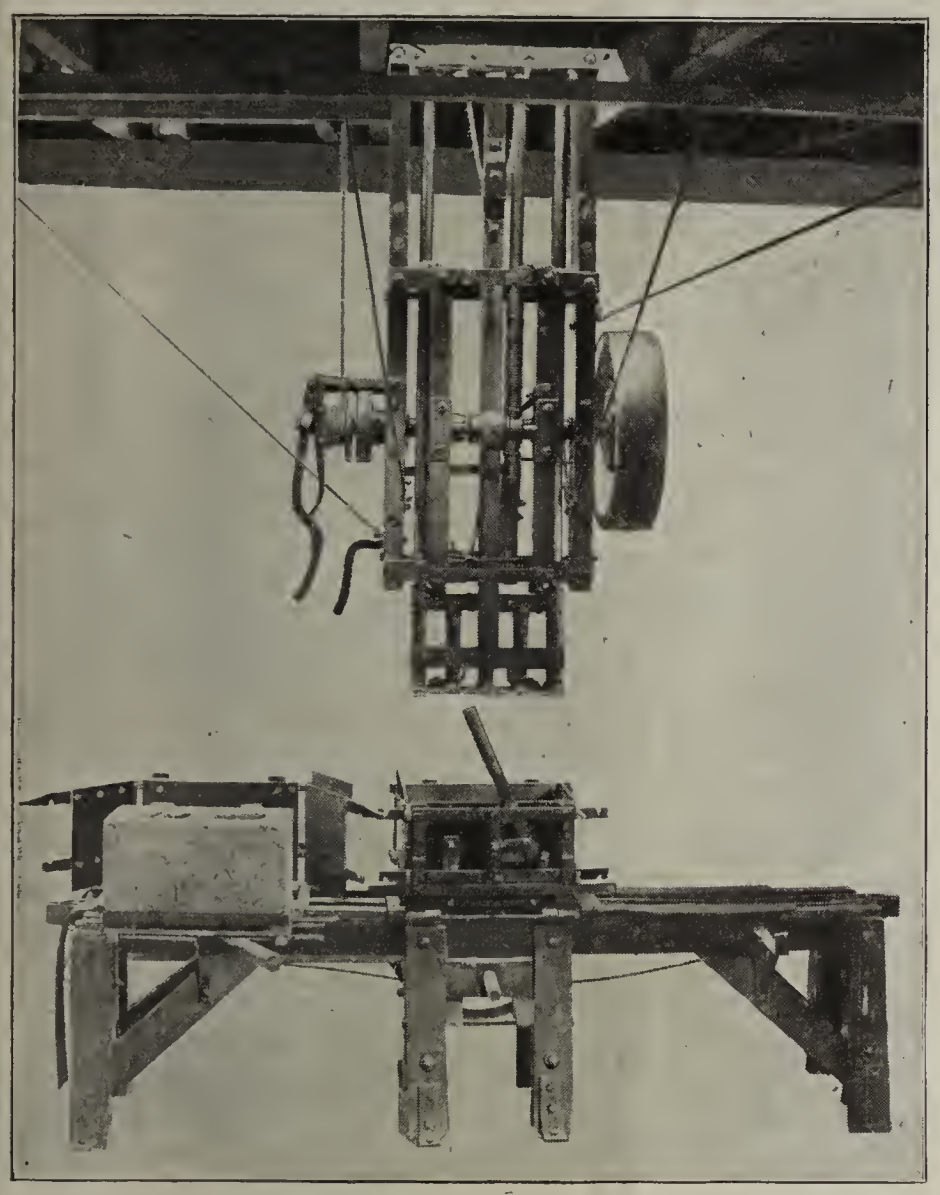
General View of New Mixer Made by Municipal Engineering and Contracting Company.

ground level by wheelbarrows. A simple cable hoist elevates the hopper for discharging into the drum. The discharging arrangement is a swinging chute operated by a hand lever. Any part of the batch, or the whole batch, may be discharged at one time by suitable manipulation of the swinging chute, and when mixing, the chute is completely removed from the possibility of catching and discharging portions of the batch. The No. 0 mixer is rated with a daily output of 50 cubic yards when operated by a 3 hp. hopper-cooled gasoline engine. Specifications for this size call for a steel frame, steel axles and steel wheels. The size of the front wheels is 16x2½ in. and the rear wheels have dimensions of 20x2½ in. The drum is made of blue annealed steel and the heads are semi-steel. Chilled friction rollers are provided and a friction clutch is between the engine and the mixer. The No. 1 mixer is driven by a 4 hp. hopper-cooled gasoline engine and has a daily output of between 70 and 80

cubic yards. The size of the front wheels is 24x5 in. and rear wheels 36x5 in. The engine is covered with steel housing and there is a charging elevator and water tank. The elevating and discharge levers are operated from the discharge side of the machine. A view of one of the mixers is shown herewith. Mixers are also made with capacities of 7½ and 10 cubic feet. A special catalog may be had on application to the company. Write for Catalog No. 21.

THE GREER BLOCK MACHINE

The cement block machine shown here claims a number of interesting points. Among them is the care with which it is fed and the blocks removed. It is claimed that this makes possible continuous operation.



A Concrete Block Machine Which May Be Operated Continuously.

The blocks are easily taken from the molds, and the cores are vertical, so that there is no danger of caving in, even when the mixture is quite wet.

The use of the double block on a sliding table enables the operator to remove the completed block while the tamper is working on the other. When the block is completed a turn of the wheel removes the finished block from under the tamper and places the empty mold in its place. Since the machine is in motion only when tamping, and this is completely under control of the operator, this operation is governed entirely by the speed of the attendant.

Since the only exertion of power that is required is in the actual operation of tamping, the economy of power is marked over machines in continuous operation. There is also an advantage in the absence of noise.

The tamper operates from the top, and the strength of the stroke is maintained throughout the operation. This enables the use of much damper material without danger of the facing sticking on the machine, and at the same time insures a uniform consistency without soft spots. The block is pressed hardest on the face, giving a fine finish.

The machine has been in actual use for three years, and the testimony of owners is agreed as to its rapidity, economy and durability.

It is made by the Greer Machinery Company, 292 Toledo street, Delaware, Ohio, who will send further information on request.

CONCRETE, THE MATERIAL BEAUTIFUL

Concrete in its higher decorative and artistic features has a devotee in Amos Stouffer, proprietor of the Art Stone Company, Box 330, Waynesboro, Pa.

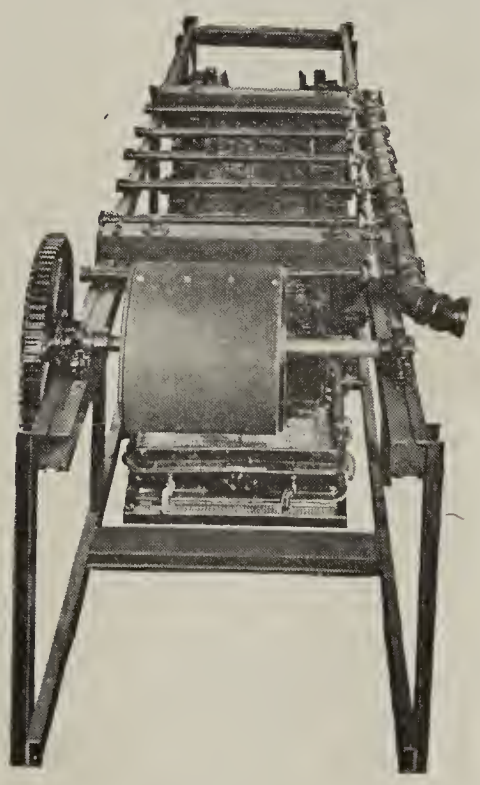
Mr. Stouffer has devoted many years to procuring artistic effects from various classes of concrete work, and his products are marvels of painstaking application. The beautiful things Mr. Stouffer has made show the result of his many years of research and effort to elevate concrete to its proper plane so far as its artistic potentialities are concerned.

Mr. Stouffer is able to imitate marbles, granite, sandstone, onyx, and other natural stone. He gets fine tone and color effects by different mixtures and proportions of Portland Cement and Medusa White Cement and by different formulas with colored aggregates such as granulated granites, marble, limestone, sand, gravel, and sundry special mixtures he succeeds in obtaining the life, tone and texture and sparkle of the natural stone. Mr. Stouffer has largely discarded all foreign colors, pigments and stains.

Mr. Stouffer is a gentleman over seventy years old, and he devotes himself almost entirely to laboratory work. He has discovered many new uses for concrete, and his formulas, methods and processes are offered to younger men who would like to carry on in their respective localities the kind of work Mr. Stouffer is doing.

The Gravel Screen of No Regrets

(Patented)



This E. & S. Twin Shaker Screen with Washer Attachment and conveyors recently replaced a $30,000.00 Screening and Washing Plant of a different type, and is today turning out 60 yards per hour of perfect graded and clean sand and gravel of five different sizes at an operating expense of less than One Cent per yard for both the screen and washer. Any size screens down to 30 mesh can be used, doing away with a settling tank if desired. At times as much as 50% clay is washed from the material.

Minimum operating cost and up-keep with maximum capacity, perfect grades and clean material means Larger Profits.

We design and install complete plants.

Send for catalog and information on the E. & S. Twin Shaker Screens and Conveying Systems.

THE EXCAVATING & SCREENING MCHY. CO.

748 Security Building **Minneapolis, Minn.**

WATERPROOF BURIAL VAULTS PRESERVE THE REMAINS

Artistic and everlasting, airtight, germ and waterproof, makes the cement burial vault a perfect receptacle for the dead.

The Fond du Lac & Winnebago Vault Company have been manufacturing concrete burial vaults for the past six years. They had the opportunity at several disinterments of their vaults, made with Medusa Waterproofed Portland Cement, to find them water and damp proof, showing no penetration of moisture.

Concrete Burial Vault Factory of the Fond du Lac & Winnebago Vault Company.

On September 3, 1912, they placed the remains of a very prominent church dignitary in one of their vaults, and one year from date of burial they exhumed the vault and remains and found that no moisture had penetrated this vault, as the remains were as well preserved and the casket in as good a condition as on the day of burial, and the remains were viewed by scores of people in the cathedral for days.

The manufacture of concrete burial vaults is a proposition every cement contractor should be interested in. He can make money during the winter just as well as during the building season. It doesn't cost much to start in this business, and it's steady the year around. Chas. F. Russell, Greenbush, Va., started manufacturing concrete burial vaults three years and a half ago. He uses adjustable steel molds manufactured by the Automatic Sealing Vault Company, 216 East River street, Peru, Indiana. The first year he sold thirty-eight vaults, the second year 108 vaults, the third year 162 vaults, and this year is averaging a vault a day.

Last year his net profit was better than $3,000.

SELF-PROPELLING WAGON AND TRUCK LOADERS

The Jeffrey Manufacturing Company of Columbus, Ohio, manufacturers of elevating, conveying, crushing, screening and power transmission machinery, have just received from the press their latest Bulletin No. 177-14 featuring their self-propelling wagon and truck loaders for handling crushed stone, sand, gravel, clinker, coke, etc.

These machines have a capacity of 1 to 1½ cubic yards of material per minute, will load crushed stone maximum size pieces through 3½-inch ring, and will load trucks or wagons in three or four minutes, saving the wages of from two to five shovelers.

The self-propelling device enables one man to operate the loader as it is fed into the pile, and move the machine about under its own power.

These loaders are driven by 5 H. P. I. motor or 6 H. P. gasoline engine. The type "A-15" loader is built with a collapsible elevator, which makes it available about all parts of the yard and easier to operate over rough ground; also permits it to be used where low sheds, trestles and other overhead obstructions are encountered.

The bulletin contains illustrations of many interesting installations, specifications, prices and complete details of their different types of loaders. A free copy of Bulletin No. 177-14 can be obtained by any one interested by writing to the factory office of the Jeffrey Manufacturing Company, 914 North Fourth Street, Columbus, Ohio.

CAN PREVENT THE IMPROPER CONSTRUCTION OF CONCRETE ROADS

The fact cannot be too strongly impressed upon the minds of the public and the officials of municipalities that the cement manufacturers are doing everything within their power to further the education of the contractor and road builder and to prevent the improper construction of concrete roads.

Many of the cement manufacturers will procure at any time for those contemplating concrete road building or road construction of any character the services of a competent, experienced engineer for consultation or supervision in connection with the work.

If the layman, the voter, will take sufficient advantage of the efforts being made by the manufacturer he will find opportunity to extend his own co-operation in bringing the authorities to a recognition of the importance of taking advantage of the expert knowledge and experience of the engineering department of the Association of Portland Cement Manufacturers.

Handling Crushed Stone at the Yards of McQuaide & Bannigan, Utica, N. Y., with a Jeffrey Self-Propelling Truck Loader.

LANSING FIVE

—Rotary Pump
—Side Loader
—Ideal or Novo Engine
—Gear Driven
—Folding Platform

—Silo Hoist
—Batch Hopper
—Water Tank
—High Wheels
—Wagon Tread

THIS MIXER MUST EXCEL

It has been a positive necessity for us to make the Lansing Five the best mixer in the world at anywhere near its price. We went into the business of making mixers knowing that the field already was well filled, that many concerns were making good mixers and selling them at reasonable prices. But, backed by a great thirty-five year old concern with a paid-up capital of $1,500,000 and a world-wide reputation, we entered the field with a reputation and standard to uphold, not with a reputation and standard to create. So, obviously, we had to build a mixer which would stand head and shoulders above everything else in its class. We were forced to make the Lansing Five excel —AND IT DOES.

LANSING COMPANY
"KEEP YOUR PRODUCT ON WHEELS"

Write for Catalog 354-M

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WAREHOUSES:
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High-Grade, *Low*-Priced Drum Mixers

Backed by Austin Engineering

When it comes to volume, rate and quality of output, working life, low maintenance cost and simplicity of operation, operation, we invite your most rigid inspection of the design, construction and performance records of

Austin Drum Mixers

Discharge Side of No. 1 Austin Drum Mixer

The charging arrangement is a hinged funnel-shaped steel plate hopper, which when lowered can be filled at ground level from barrows. For discharging into the mixing drum the hopper is elevated by a simple cable hoist.

A hand lever operates the swinging discharge chute. During the mixing operation the chute is set in such a position as to avoid any possibility of catching and discharging portions of the batch, yet by a simple manipulation of the chute the whole batch or any portion can be discharged at one time. All operations are controlled from one position.

Equipped with hopper cooled gasoline engine in steel housing. Capacities 4½, 6½ and 10 cu. ft. of mixed concrete.

MEMBER OF NATIONAL ASSOCIATION OF MIXER MNFRS.

Our Mixer Capacities Based on N. A. M. M. Wet Batch Rating

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Chicago

Send me catalog No. 21-D. I want to know more about high-grade, low-priced drum mixers and pavers made by the builders of Austin Improved Cube Mixers.

Name .....

Address .....

.....

AN INEXPENSIVE METHOD OF TRANSFORMATION—OLD BRICK BUILDING GIVEN A FINISH OF WHITE CEMENT

In converting a St. Louis four-family flat building into a cafe and restaurant, Klipstein & Rathmann, St. Louis, Missouri, architects, used white cement with excellent effect. The rejuvenated building contains a cafe with tile floor and beamed ceiling, and a dining room. The second story is arranged for two living apartments.

The original first floor was four feet above the sidewalk. This was lowered, the front wall removed, and the upper structure supported on columns. A one-story pavilion with green enameled brick piers, rough cast cement arches and red tile roof was built on the front.

The second story windows are the old windows. The surface of the old brickwork was roughened to form a bond and the entire front wall then covered with rough cast Medusa white portland cement, manufactured by the Sandusky Cement Company, with half timber gable and red tile roof. A stork and nest crown the gable. The ornamental frieze above the second story windows is of plaster cast, in slabs four inches thick, and is built into the brickwork.

Before Using White Cement.

After White Cement Was Applied to the Old Brick.

"DOUBLE SPEED" BLOCK AND BRICK MACHINES

The term "double speed" has been adopted as the trade name for a line of block and brick machines manufactured by the Monarch Mfg. Corp., Boone, Iowa. They are claimed to be the machines "which pay for themselves in twelve working days."

The brick machine makes the brick face down, sixteen at one operation. Three sets of face plates are furnished with it—plain, panel and rock.

The same three types of faces are also furnished with the block machine. This latter turns out two blocks at one operation. It makes blocks either hollow or solid; also return-end face blocks, water table blocks, chimney blocks and silo blocks.

SAND AND GRAVEL COMPANY WILL MANUFACTURE CONCRETE PRODUCTS

The Waupaca Sand & Gravel Company, Waupaca, Wis., has recently made arrangements to increase its capital stock from $15,000 to $25,000, the additional capital to be expended in the erection and equipment of a large concrete products factory specializing particularly in concrete sewer pipe and drain tile.

The company is now manufacturing concrete blocks for the erection of this building.

It is the intention to install a machine which will make sewer pipe ranging in diameter from 4 to 24 inches, and the company is already making bids on contracts for this class of work which are to be let this spring. The company believes that it can occupy the time profitably during the winter months especially, in manufacturing concrete products, at the time when business at the gravel pits is suspended.

CEMENT PLANT FOR WELFARE WORK

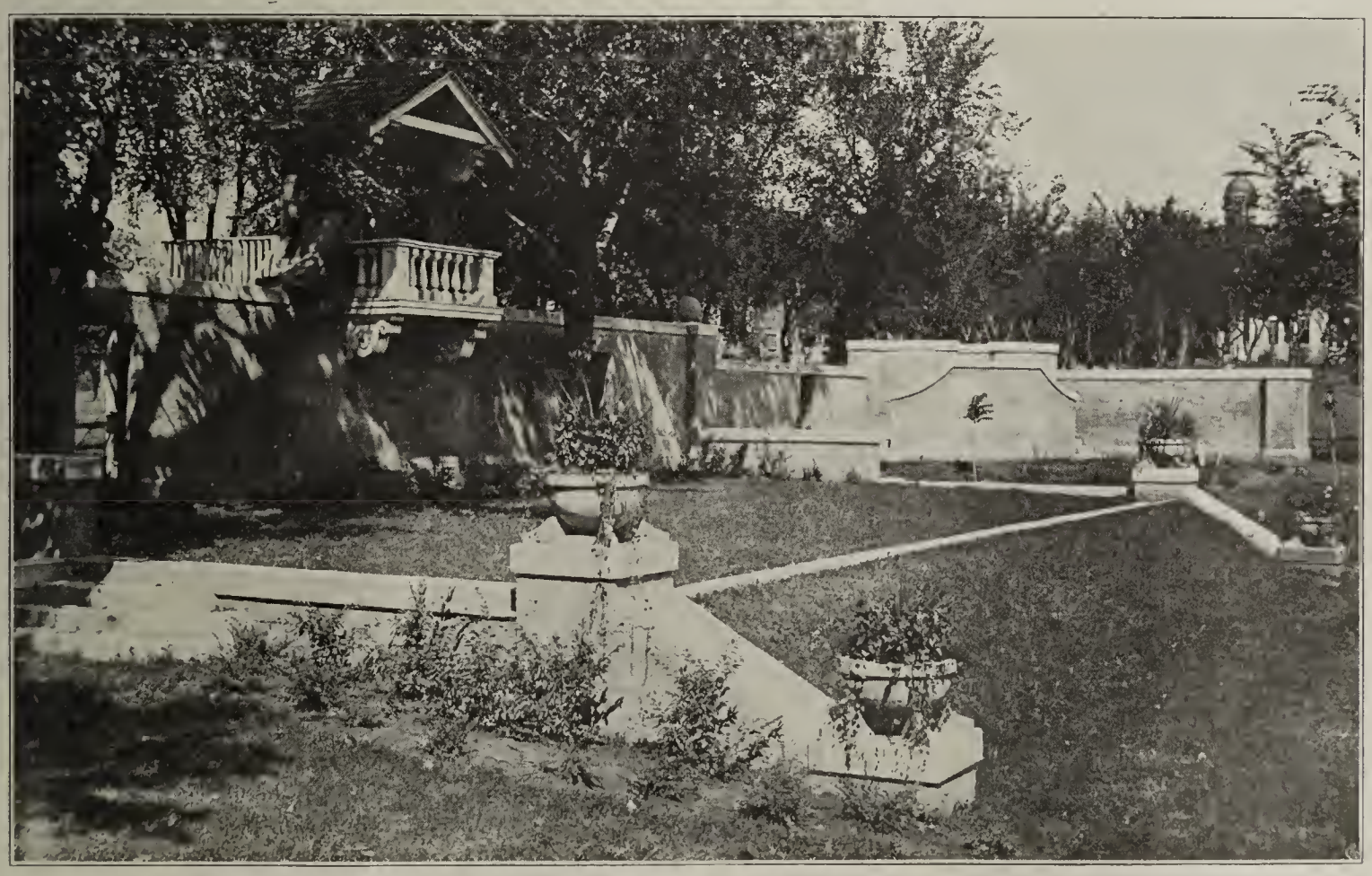
Plans for welfare work are being developed by the Louisville Cement Company at its big cement plant at Speeds, Ind. As soon as work is slack, making men available, a wash and dressing room will be built, and on the second floor there will be recreation and reading rooms. The company some time ago built a number of cement houses, which are rented to their employes, and it is considered a privilege to have the refusal of one of the houses, which constitute what is known locally as the "white city." The company also has a practice of distributing bonuses to its employes at Christmas, based on length of service.

Many manufacturers of concrete building block units will do well to rid themselves of the idea that their materials are not specified for good work because of prejudice. Sound, *good-looking* units are in demand. Be prepared to let the man who uses the material decide as to whether or not it is good looking.

Pergola at Rear of Concrete Garden Wall. Steps Mount from Middle to Railed Platform Which Leads to Stage Balcony.

Yankton College Campus

The accompanying illustrations show some of the concrete work of the Garden Terrace Theater on the Yankton College Campus, Yankton, S. D. This is a unique and beautiful open-air stage and ampitheater built for Yankton college and community purposes by private local enterprise. The theater enclosure, which consists of hedge and garden wall, is 140x200 feet, and will seat 2,500 spectators within perfect area and hearing of the stage. The terrace, or stage proper, is 30x60 feet, but on occasions the entire stage end of the garden, an area 50x140 feet, may be used for a dramatic scene or pageant spectacle. The theater is provided



Stage of the Garden Terrace Theater, Yankton, S. D., Showing Ornamental Concrete Work.

with complete and permanent equipment for electric stage lighting and illumination. The seating provided is light folding chairs which are removed when not in use, leaving the entire seating area a beautiful sloping lawn.

There is a fountain at the rear of the stage forming one of the ornamental features, and there will be garden seats of concrete and other ornamental objects of sculpture to carry out the style of the formal Italian garden.

The roof of the Garden Terrace Theater, built on the college campus, is the sky, its floor the green turf and its walls, except such as are of concrete, are the foliage of trees and growing things. This much is true, to be sure, of many another of the open-air theaters which have lately sprung into such wonderful favor in all parts of the country. But this one is different. There is no other like it in the United States.

It is provided with a concrete and stucco terrace stage and concrete and stucco wall with concrete stage, balconies and pergolas. The theater is a community enterprise. It is intended as a civic center, a means of an artistic and educational inspiration for the whole community as well as for the use of the college.

It is stated that the idea and design of this permanent open air theater are original, yet absolutely sound in conception, from both the practical and artistic standpoints. The practical features of its construction were developed out of the experience of the past eight years of the college in presenting a Shakespeare play out of doors at commencement time. Those features, particularly the structure of the stage, were based upon the stage of Shakespeare's time in London, having two rear entrances and a stage balcony, but without curtain or wings and with a minimum of movable properties.

It is maintained that the architectural and landscape design chosen for this purpose, although without precedent in the history of open air drama in this country, is nevertheless based upon perfectly sound principles. The thing is essentially an Italian garden, enclosed in formal hedge and garden wall, with a terrace for the stage and sloping lawn for seating and audience. To be sure the Italian garden, with its characteristic wall architecture, sculptural ornament and formal landscape, is not unknown in this country. It has become a feature here and there in the fine city parks and wealthy private estates. But the adapting of the Italian garden to theatrical purposes, with stage and seating area, is the thing that is original with Yankton college. And yet this very idea is not an absolute novelty, but a revival, for it is taken directly from some of the beautiful old villa gardens of Italy, built centuries ago.

It is pointed out that it was a custom, in the times when those world famous gardens were laid out, to include in the design of the grounds a private garden theater with a terrace for the stage and suitable seating place for spectators. There the nobleman would entertain his guests by a play performed by amateurs of his household or by companies of traveling actors. Those old garden theaters of Italy are known to tourists and to landscape architects, but no modern adaptation of them for theatrical purposes, so far as diligent study of the subject has been able to discover, was ever made until this present enterprise at Yankton.

The detail plans for the Yankton garden theater were prepared by Phelps Wyman of Minneapolis, the man who has drawn the preliminary sketches for the proposed park system of Yankton and who laid out the state capitol grounds at Pierre, and the wall architecture by A. R. Van Dyke of Minneapolis, a specialist in that particular field of design. These architects, both of whom were appreciative and enthusiastic over this unique subject, gave to the project very particular study and worked in collaboration to produce the design which was finally adopted. In order to secure the utmost possible assurance of the practical feasibility and artistic propriety of the garden theater, the architect's plans were gone over in conference with a number of leading authorities on dramatic art and open air entertainments in the United States.

Prof. E. E. Giesecke, head of the division of engineering in the Bureau of Economic Geology and Technology of the University of Texas, at Austin, has just issued a bulletin in which he describes the preliminary results of a series of experiments in the preparation of concrete.

REDUCING QUARRY COSTS

The following details are of a blast made at the quarry of the Rensselaer Stone Company, Brainerd Station, N. Y., in June:

The shot consisted of nine 5⅝-inch well drill holes, varying in depth from 20 feet to 64 feet. Holes were spaced 20 feet apart and 20 feet back from the face. The rock in this quarry is a hard gneiss weighing about 170 pounds per cubic foot. The stone is crushed for railroad ballast and commercial purposes. This operation formerly used Du Pont Straight and Gelatin Dynamite but have recently adopted Red Cross Extra Dynamite and find that this explosive is giving better results than any heretofore used.

Holes were loaded with from 250 pounds to 600 pounds each. Some of the holes contained as much as 8 feet of water, and although the Red Cross Extra was loaded loose in the bore holes and allowed to remain in some holes seven hours before firing, excellent results were obtained.

In all 3,100 pounds of Red Cross Extra 60% and 1,350 pounds of Red Cross Extra 40% were used in the shot. Two No. 6 Electric Blasting Caps were primed in each hole; connections made in series and blast fired with a Du Pont No. 5 Blasting Machine.

Stone was well broken and face pulled to grade. The quarry officials were well pleased with the results and say that it was the best blast ever made at the quarry with any other explosive. About 16,000 tons of stone were shot down in this blast.

Why not try Red Cross Extra in your quarry, Mr. Quarryman? A big saving in money is possible and just as good execution is assured.—Du Pont Magazine.

PHOTOGRAPHS OF CONCRETE WORK.

The Portland Cement Association, 111 West Washington Street, Chicago, is conducting a photographic competition for the purpose of securing pictures showing the many ways in which concrete has been used.

Cash prizes will be offered for some of the best pictures received and all others which may be entered in this contest and which prove suitable for use for advertising and booklet illustrating, will be purchased at a fair price. Any good picture of concrete work is therefore likely to be worth money to you.

LOCATION FOR CEMENT PRODUCTS BUSINESS

Hawkins Sand Company of Marshalltown, Iowa, write that they would be glad to communicate with parties who would be interested in a location for a cement products business.

CEMENT TILE AS A WINTER BUSINESS

The problem of "what to do in the winter" is a big one to many concrete men, and suggestions in this direction should be read with interest. The vast increase in the use of cement drain tile has opened up a business which lays claim to the attention of concrete men wherever farmers drain their land.

The manufacture of cement drain tile opens up a new winter business, as tile can be made on days and in weather that would be unsuitable for outdoor work. Practically all manufacturers of cement tile make the larger part of their stock in the winter and store it against the spring demand. In this way they can keep busy all the year around besides being able to furnish work so as to keep their crew busy all the time.

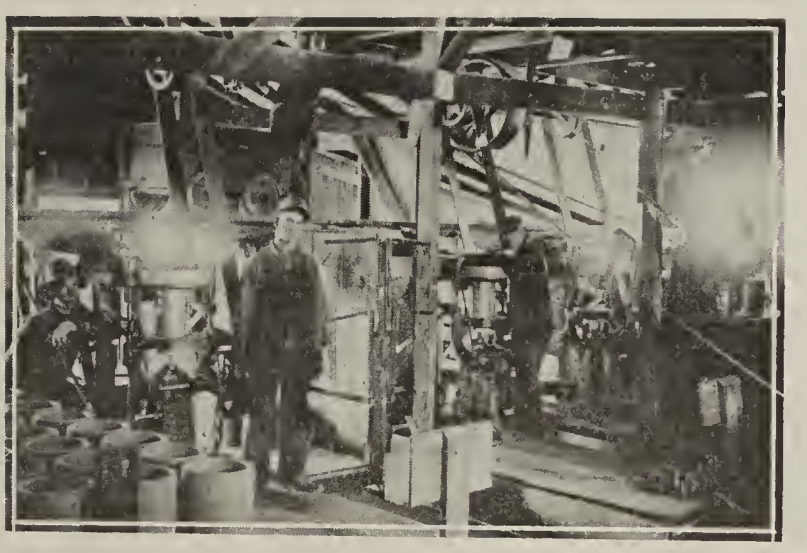
Among the many instances we may quote the experience of Mr. P. A. Quanstrong of Genoa, Illinois. Previous to the Cement Show in February, 1913, Mr. Quanstrong's business has been building silos, among other things. He had a good crew of men, trained to his work, and desired to keep them permanently employed; this meant he had to find something for them to do during the winter months. Among the many exhibits which Mr. Quanstrong saw at the Cement Show none attracted his attention more than that showing drain tile manufacture. After spending some time at this exhibit getting information as to manufacturing costs, selling prices, etc., he went back to Genoa and investigated the market for drain tile in his territory. The result of his investigations appeared favorable, and he decided he would try his luck in this business.

He obtained a machine and necessary equipment and made up a stock of tile. From the start he was successful, as sales came with very little effort. When he set the prices of his tile, Mr. Quanstrong considered that he would have to compete with clay tile; but very soon he saw that the prices of the two kinds of tile did not cut much figure, as farmers preferred the cement tile. After running his tile plant the entire year, the third winter found him behind with orders. As a consequence he doubled the size of his plant, put in a conveyor for material from his sand pit, an overhead screen and a larger tile machine. The business he was doing warranted this, and his profits paid for it. In addition he found that he could keep his men on a profit-producing basis throughout the winter months, besides having a business which fitted hand in hand with his outdoor work in the summer. In the last year his profits in thousands could not be counted on one hand.

Another experience is that of Carlson Brothers of St. Peters, Minn. Up to 1913 their business consisted of laying sidewalks, foundations for buildings, and general contract and cement products work. Practically all of this was outdoor work, and they had begun to realize the value of some side line that would enable them to keep the wheels turning when outdoor work was not possible or desirable.

Like Mr. Quanstrong, their interest in cement tile was aroused by an exhibit at the Chicago Cement Show several years ago, and they were quick to act on what they saw. Throughout 1913 and 1914 their tile machine operated almost continuously and during 1915 they found it necessary to greatly enlarge their plant. For the past year their tile department has operated in full every day except Sundays and holidays.

Instances like this can be numbered by the hundreds, so that the manufacture of cement tile has already gone a long way toward solving the problem of keeping busy in unseasonable weather. The investment required for tile making equipment is not large in proportion to the returns possible, and we urge every reader who fears the slack season "bogey" to investigate this business as much as possible.



CEMENT AND ENGINEERING NEWS

(PUBLISHED MONTHLY)

WILLIAM SEAFERT, Editor and Publisher

Office—672 Transportation Building, Chicago

Telephone, Harrison 5397 Cable Address, "Seaferts" Chicago

Entered at the Post Office at Chicago, as second-class matter, July 21, 1896 under Act of March 3, 1879

SUBSCRIPTION RATES:

United States, Canada, Philippine Islands and Mexico, $1.00 per year; all other countries, $1.50 per year.

DISCONTINUANCES—The greater part of our subscribers prefer NOT to have their subscriptions interrupted, in case they fail to remit promptly for renewal. It is therefore assumed, unless notification is given to the contrary, that the subscriber wishes to continue taking our paper. Therefore CEMENT & ENGINEERING NEWS will be sent until we are notified to discontinue—Such notice should be sent when the subscription expires.

Advertising copy or changes in ads. must be in this office by the 25th of each month, as hereafter our magazine will appear on the 5th of the following month

Advertising Rates Sent on Application

JOHN F. WALDRON - - - - - - - - Advertising Manager

CHICAGO, DECEMBER, 1916

TENTH CHICAGO CEMENT SHOW

The unusual number of manufacturers and producers of building materials and concreting equipment who have already made application for space at the Tenth Chicago Cement Show make it highly probable that builders who attend the 1917 show will find an even wider range of products and equipment than was presented at the ninth show. In addition to the standard machines which will be displayed, a number of the better of the new machines and devices which have been developed since the last show will be on exhibition.

Every possible effort is being made by the show management to conserve the available space in order to accommodate as large a number of applicants as possible. Exhibitors have been requested to make application for the minimum amount of space in which their exhibits can be installed and the arrangement which eliminates the drawing for space and permits the management to make direct assignments should do much towards saving space and making the show truly representative of the industry.

The joint exhibit of cement companies at the tenth show will in all probability excel the last exhibit in real educational value. Cement manufacturers have contributed more money for the exhibit, and the plans to show concrete products in the making should make this exhibit worthy of careful study.

The American Concrete Institute will convene in Chicago at the Hotel La Salle, February 8, 9 and 10, 1917.

A CORRECTION

In our October issue we reprinted two articles, namely "The Construction of Concrete Porch Floors and Steps," and "Roller Conveyors for Handling Cement," from the Contractors' Atlas, published by the Atlas Portland Cement Company. We failed to give them credit for these articles, an omission which we are glad to correct.

YULETIDE GREETINGS

We extend to you the greetings of the season, with the sincere wish that the coming year will be one of progress, peace and prosperity.

STRENGTH OF CEMENT AND HYDRATED LIME MORTARS

Tests of various kinds of mortar were made recently by James S. Macgregor, Professor of Civil Engineering at Columbia University. Seven sets of brick piers, 8 by 8 by 84 in., were constructed. There were nine piers in each set. A different kind of mortar was used for each set. Three cylinders of each set were tested to rupture at 7 days, three at 28 days, and three at 90 days. The results are tabulated below, together with the cost of mortar per 1000 bricks, assuming the price per ton, and of sand, $0.80 per ton.
of cement to be $1.80 per bbl., of hydrated lime, $10.50

Set number	I	II	III	IV	V	VI	VII
Cement, cu. ft.	1.00	0.90	0.85	0.75	0.50	0.25	....
Sand, cu. ft.	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Hydrated lime, cu. ft.	....	0.10	0.15	0.25	0.50	0.75	1.00
Cement, lbs.	100	90	85	75	50	25	....
Sand, lbs.	300	300	300	300	300	300	300
Hydrated lime, lbs.	....	4	6	10	20	30	40
Ultimate strength, lbs.							
At 7 days	2630	3080	2890	3120	2760	1945	1535
At 28 days	2840	3170	3230	3470	3100	2370	1870
At 90 days	2840	4435	4300	4170	3820	2720	1950
Cost	$2.18	$2.08	$2.03	$1.99	$1.77	$1.48	$1.24

It will be noted that several of the mortars using hydrated lime, No. V in particular, showed as good or better results than the straight cement mortar and at a considerably reduced cost.

SHORTAGE OF CARS FOR SAND AND GRAVEL

Shortage of cars has handicapped the Roseburg Sand & Gravel Company, Roseburg, Oregon, for two months. The management does not lay all the blame on the actual shortage of cars, so much as to the neglect of railroad employes in failing to keep cars on the move.

When Manager Larsen runs short of cars he makes a trip up and down the railroad and spots the empties on the siding as he drives by in his motor car. Armed with this list he asks the railroad company for certain cars, giving their locations and numbers. In this way he has kept the plant running part capacity.

Mr. Larsen says that the failure to supply cars when needed keeps road contracts from being filled rapidly, and causes delay and loss of time to contractors and workmen.

At one time he found an empty car lying idle for 16 days straight, within two miles of Roseburg.

A VIRGINIA CONCRETE PRODUCTS MANUFACTURER

Mr. Charles F. Russell of Greenbush, Va., who has been manufacturing concrete products for the past five years, writes Cement and Engineering News as follows: "I make concrete burial vaults with molds bought of the Automatic Sealing Vault Company, 216 East River street, Peru, Ind. I am well pleased with them and if I were going to buy more I would get the same kind. My cement drain tile machine was furnished by the W. E. Dunn Manufacturing Company, 414 Twenty-fourth street, Holland, Mich., and is rendering good results. I believe it is the best drain tile machine on the market. Am well pleased with it. I also manufacture concrete blocks. I use the Zaglemeyer Cast Stone Block machinery and am thoroughly satisfied. I find these molds to give the best of service."

Permanent Farm Building Construction

BY PROF. M. H. HOFFMAN

Agricultural Department, Iowa State College, Ames, Iowa.

(Continued from November Issue.)

Concrete tanks is another thing that I want to say a word about. These are being put in by a great many farmers over the country, and some of them are good and some of them are very bad. I remember being in Washington county last fall where a man told me that he had built a concrete tank but he had not put in any reinforcing. At the end of four days he turned on his windmill, and when he got his tank about half full it broke in two and half of it rolled down the hill.

I was over on a farm in the eastern part of the state and noticed a farmer had a pile of broken concrete about five feet wide and twelve feet long, and I asked the farmer about it and I noticed that he was not anxious to tell. I said, "What happened to your water tank?" He said, "It busted." "I rather gathered that it had broken," I said. "I did not have any reinforcement in it," said he. "When did it break?" I asked. "As soon as I put the water in it," he said. I said, "It did not freeze." He said, "No." "Where did it break?" I then asked. "All around," he said. I learned that after it broke he put dynamite under it and blew it up. I said, "I suppose the next tank you put up you will put reinforcement in it." He said, "I am not going to put up any more."

But the next day over in another county I saw a fine looking concrete tank. I said, "That is a fine looking tank you have there." "Yes," he said, "but you ought to have seen the first one." I said, "Was there another one?" and he said, "Yes, and it cracked all around as soon as I filled it. I immediately got a stick of dynamite and blew it up before any of the neighbors saw it and carted it away into the ditch." Then he said, "I wrote and got a book that one of the Portland cement companies send out, and I built the tank exactly according to those specifications, and that is what you see right here." And he certainly had a very good looking tank. But a good many of them are built with no reinforcement, and others have old fence and wagon tires and anything in the way of reinforcement. I think old barbed wire fence is a good thing to put in the bottom of a foundation trench and get it out of the way. That is where some of the farmers put in old horse shoes and in the wet counties they put in beer bottles and everything else.

Delegate: Was that in Iowa they put in beer bottles?

Mr. Hoffman: Yes, that was before we went dry.

I may say also that I believe in reinforcing both ways in building these tanks. A good many people reinforce with woven wire fencing. I think that is all right, providing enough is put in and it is put in right, but I have seen some failures where it was used. Take this American woven wire fencing, it makes a very good fence, but I know of at least one instance where it failed to work in a tank. You are all familiar with the fencing. The vertical wires are not continuous from top to bottom. Hence it would not be useful in reinforcing up and down to prevent horizontal cracks. I have seen one tank that was reinforced with just one line of American fence that had a longitudinal crack in it a foot from the top. I believe that the trouble was that the tank froze from the top and the top was lifted enough to cause such a crack, and I believe that it will do that if that kind of fencing or any that has non-continuous vertical wires is used. It would probably have been all right if more than one piece of fence had been put in, so that it had been reinforced both ways.

The way we recommend that a tank be built is to put in plenty of steel. We figure that if a man does that he cannot go far wrong. Put in quarter-inch steel across the bottom of the tank and up the sides an inch from the inside, and if there is no foundation, extra pieces of steel across the bottom. The horizontal steel we place near the outside wall, cutting the corners and going around the tank. We are not afraid of any tank failing that is reinforced like that.

Delegate: Near the outside?

Mr. Hoffman: Yes, near the outside.

Delegate: How far apart?

Mr. Hoffman: Four inches apart. And the ones that go down we put eight inches apart. We have never had any failures of tanks that were reinforced that way.

There is one other farm building that I want to speak of, and that is the silo. We have heard a great deal about the different kinds of silos that have been put in, and sometimes it has been very disappointing, and what will probably be disappointing to you concrete men will be to hear me say that I have seen some stave silos, wood stave silos that gave very good satisfaction. There have been, however, many stories told of failures of concrete and clay block silos that, on investigation, were found to be untrue. At Des Moines at the State Fair there has been for several years an exhibit of different types of silos. A year ago last fall an exhibitor, in running down a competitor's silo, showed a farmer a picture of the inside of such a silo with a big crack in it. The farmer asked the exhibitor where he got the picture, and was told the man's name and where he lived. The name and the place were the farmer's own. Now, the farmer had a silo of that description but it was not cracked, so he asked the exhibitor more about it. At last he asked, "Are you sure that this was this man's silo?" "Yes," said the silo man, "for I took the picture myself." "In that case," said the farmer, "it must have cracked since I left this morning, for I am that man, and when I left it was all right." (Laughter and cheers.)

There are three kinds of concrete silos that are now being built, the monolithic, concrete block and concrete stave silos. If they are properly put up, those three kinds of silos will all stand. I know of some failures in all of these three kinds, but they were the fault of the construction and not the kind. There was one over in Clark county, a cement stave silo, that failed, but the staves were not well made and the silo was not put up properly. It had a dent in it on one side that showed it was poor workmanship, and when the wind blows hard pieces of the cement fall off, and nobody is anxious to get very close to it on a windy day.

Concrete silos will give good satisfaction all the time if they are properly built. I have heard the argument that the silage spoiled more quickly in them on the sides. When I was making a trip through one of our southern counties a year ago a question was put to me like this: "What do you find as to the nature of the silage in a wood stave and in a masonry silo, right close to the sides?" In reply I asked the inquirer

what his experience had been, and he said: "I now have two clay block silos. I formerly had two wood stave silos and it is my impression that the silage right next to the walls in my clay block silos is not quite as good as it was in my wood stave silos." I then asked if anyone else had a similar experience, and another man said: "I now have two silos, one a wood stave and one a clay block, and it has been my experience that the silage right close to the walls in the wood stave silo is not as good as in the clay block silo." So there you have another opinion. I don't think there is very much difference between the silage in one or the other. I have seen just as good silage come out of one kind as out of the other, and just as bad come out of one kind as another.

Over near Cedar Rapids, Iowa, I saw a silo, concrete block, continuous air space, and they had trouble with the silage freezing. The hired man had been taking it out of the silo, and I went out with the owner and we climbed up and looked at it and there was a hole in the middle about two feet in diameter where he had been using it down and letting the rest stick to the walls and that was frozen. I took a fork and pried it loose and found that it was all right close to the wall; that there was not more than a half inch of it frozen. That was in the month of January last year. So that I don't believe the freezing where there is trouble about freezing is so much in the wall as it is in the way it is fed out. If it is fed out in the way this hired man fed it out, there is going to be a good deal along the sides that will be frozen, but that is not in any way the fault of the silo. That has been our experience. I will be glad to answer any questions that any of you may want to ask. I thank you. (Cheers.)

Delegate: Have you had any experience in regard to acids in the silage spoiling concrete?

Mr. Hoffman: Yes.

Delegate: What causes it?

Mr. Hoffman: We have found damage by acids in both concrete and wood silos, and we believe that it is because the walls or foundations were not well built. We have examined silos that have been affected by the acids in the ensilage, and we have found that the foundation was rotted or the sides rotted, and we have gone into it and generally found that it was poor concrete to start with, poor gravel or something like that. Not properly mixed and made in the beginning, or not enough cement.

Delegate: Then you don't think we would have any trouble with these acids if we had good aggregates?

Mr. Hoffman: No. There will be some acids, especially when the corn is as it was this last year, but the effect on the concrete if you have plenty of cement and the proper aggregates will usually be negligible.

Delegate: What has been your experience as to temperature tests for silos?

Mr. Hoffman: In Iowa we made a temperature test in the middle of the silos, half way between the middle and the wall, and near the wall. The results showed very little difference between the temperatures in the wood stave, the monolithic concrete and the clay block.

Mr. Collings: Do you recommend reinforcing in the monolithic silos?

Mr. Hoffman: Yes, but the amount depends upon the diameter and the height of the silo.

Mr. Hanson: Do you think that the farmers should build their own silos or have them built by experienced concrete men?

Mr. Hoffman: Well, I think that's open to discussion. Generally speaking, I would say that they would be better built by a concrete man than by the farmer himself, but I have known of some failures of silos that have been built by experienced men. Some have fallen down when built by experienced men because they could not stand the pressure inside.

No. 46: Don't you think as a matter of fact that the farmer would be a good deal better off if he would hire an experienced man to build it for him?

Mr. Hoffman: What kind?

No. 46: Any kind.

Mr. Hoffman: Yes, usually.

Delegate: I have one in mind now. They built it 60x120. I made him a price on it and offered to give him a guarantee, but he went ahead and got the books and the material and built it himself, and when he got through I asked him how much he saved and he said $200. But I said, you have no chute on it yet, and when you get that on will you have saved $200. Now," I says, "let's be frank, wouldn't you have been better off if you had let me build it and guaranteed it and put it up right in every way than for you to have put in all your time and saved less than a hundred dollars—and not that if you count your time worth anything—and if it fails now you have no come-back." He said if he had it to do over again he would let me go ahead and build it. He said, "I have had $500 worth of grief." But, notwithstanding what he said, his neighbor turned right around and did the same thing. I don't believe that the average farmer knows how to build a silo, and I don't think the colleges should encourage them to build them themselves, or that the cement papers should encourage it. I don't believe that a farmer, if he has had no experience himself, can follow the instructions sent out by the cement companies, complete as they are many times, and build a good silo, and I don't believe they ought to be encouraged to do it. They build them and they fail, and that gives the concrete business a black eye.

Mr. Hoffman: I think in general you are right.

Delegate: I want to make this point. I may be unjust, but I think that the agricultural colleges to encourage the farmers to attempt to build their own concrete work are doing an injury to the concrete business in the state. They give the farmers the impression that they can build their own buildings on the farms, and I believe sometimes they make a big mistake, and if the farmer counts his own time as anything he don't make anything on it and he never has as good a building as he would if a concrete man put it up for him.

Delegate: The farmer figures his own time as nothing. He generally builds it in the time of year when he is not working on the farm, and so he figures his time is not worth anything, and that is another thing that gives the concrete business a black eye, because the time of year when he cannot work in the field is the very worst time of year to do concrete work.

Mr. Hoffman: Some of you have made the statement that the colleges encourage the farmer to build his own buildings. That is not the case. We do not send out any forms, largely for the reason that, except in a few cases where the farmer has had some unusual experiences, he is not competent to build a monolithic or clay block silo. We do not tell them that they cannot do it, because we don't know; but we do not recommend that they build them themselves or encourage them to do so as the gentleman has stated; but we feel in most cases it would be cheaper and better for the farmer to hire experienced concrete men to put up their buildings.

Mr. Lewis: Do you recommend building a silo all in the ground or half in the ground?

Mr. Hoffman: In the western part of our state

quite a number of pit silos have been built and are giving good satisfaction. They can be built very cheaply in that part of Iowa. Nebraska is different, and in parts of this state you would have ground that would cave in in many instances if it were built that way, and it would not drain out. In Iowa we cannot use them at all excepting along the Missouri river and a few in the eastern part of the state.

Delegate: Are they plastered?

Mr. Hoffman: Yes, most of them are plastered, half an inch to three-quarters of an inch thick. A few are bricked up.

Delegate: Is it true that the agricultural college at Ames recommends hollow tile silos in preference to concrete?

Mr. Hoffman: No.

Delegate: It has been rumored that such is the case.

Mr. Hoffman: It is not true. Matt King, who was connected with the college, invented the clay block or hollow tile silo, and naturally we were anxious to see it tried out, and some very satisfactory silos have been built with it, but as an institution we do not recommend any particular kind for all cases. It depends on conditions.

Mr. Lewis: Would it be easier to get the silage out of a pit silo than one above the ground.

Mr. Hoffman: That is a matter of opinion. I would prefer to get it out of one above the ground. It takes more time for the work of emptying a pit silo than it does the other.

Delegate: I would like to ask you if it is true that the Iowa college is recommending that the farmers build concrete roads? A farmer does not know any more about building a road than he does a concrete building.

Mr. Hoffman: No, we think that a road should be built under the supervision of an engineer, the same as a building.

No. 213: You speak as though it is practical for a farmer to go ahead and figure on his own silos?

Mr. Hoffman: Only in exceptional cases. There are some farmers who, because of their experience, will put up just as good a silo as the concrcete man.

No. 213: I think that the roads should be built and contracted for the same as the silos, and let the farmers attend to the farming.

Mr. Hoffman: Roads are now being built by the farmers, but the engineers are laying out the grades, and I think with that supervision the farmers can do as well as anybody.

THE MANUFACTURE OF CONCRETE BLOCKS BY THE HILLS CEMENT BLOCK WORKS

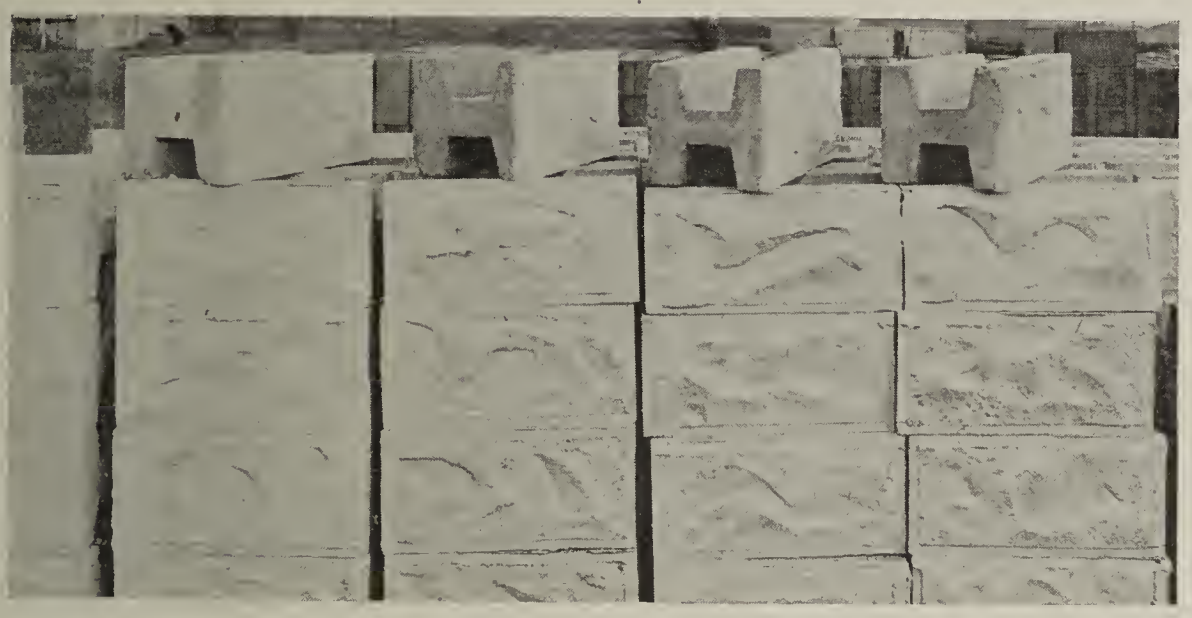
Mr. Cecil L. Gatten, proprietor of Hills Cement Block Works, Hills, Iowa, gives his experience regarding the manufacture of concrete blocks. He writes as follows:

"The Hills Cement Block Works may not as yet make as many blocks as some older concerns, but it does make better blocks than most others. It was in line with the policy of 'quality first' that I investigated the properties of Medusa Waterproofing. I wanted better blocks and to be better they had to be waterproof. Increasing the amount of cement per block made the cost of manufacture prohibitive so was out of the question.

"I consulted three civil engineers of Iowa City, one an authority on cements. The first said, 'The principle is right'; the second, 'Medusa Waterproofing is all right'; the third, 'I am specifying Medusa for the New Iowa River bridge.'

"I wrote the Sandusky Cement Company, Dept. T-7, Cleveland, Ohio, for a small supply of both Medusa Waterproofing paste and powder and tried it myself. After the first batch was cured and a block containing Medusa Waterproofing placed beside one without, I saw the light and said:—'No more sponge blocks made here.'

"My repeated tests of the identical mixture, with Medusa Waterproofing added, showed a decided gain in density. Local people were skeptical at first until they tried it themselves. One man tested brick with a large blow-torch and he was satisfied. Medusa Waterproofing is the only thing that will make a dry-tamped block permanently impervious and useful. Have also used it in poured blocks and find it successful there too. I prefer the powder form myself for my equipment, but the form don't count, neither does the work."



Wet Process Rock-Face Blocks Made by the Hills Cement Block Works, Hills, Iowa.

LINK-BELT COAL HANDLING

Two pamphlets of the Link-Belt Company describe and illustrate the most modern coal handling system yet devised, one installed at the power plant of the Victor Talking Machine Company and the other at the W. H. Grundy Company.

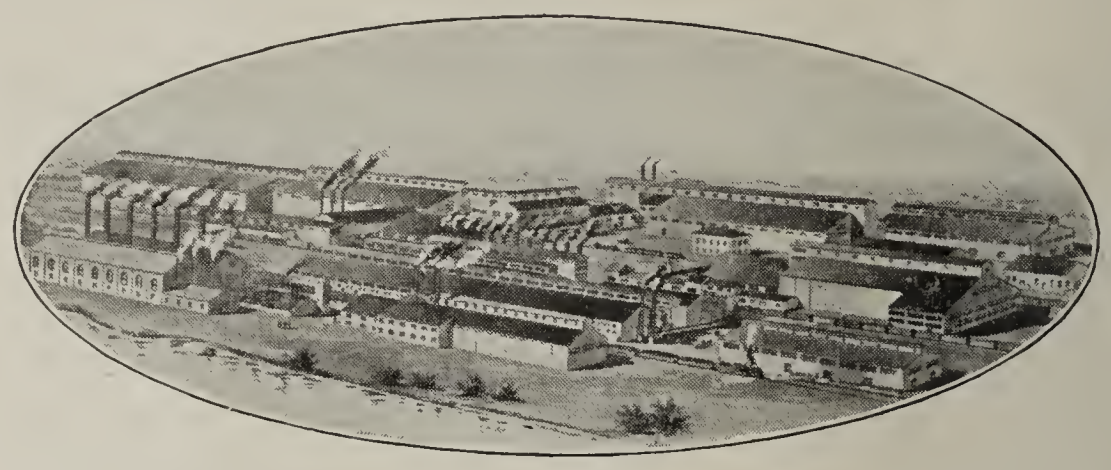
The system consists of elevating and conveying machinery of the famous Link-Belt type. In addition to a detailed description of all parts of the machinery, a comparison of the automatic system with the former method of handling coal by man power furnishes an interesting study of the saving that can be accomplished at every power plant by the installation of conveying machinery for coal and ashes.

The Modern Manufacturing of Portland Cement

BY GEO. P. DIECKMANN

Portland cement is one of the greatest building materials in this country and the consumption of Portland cement has from a few thousand barrels reached a capacity of 92,000,000 barrels annually. Portland cement is a material which has a complex chemical formula. It is composed of a combination of calcareous and argillaceous materials—that is to say, a limestone on one side and the clay on the other. Each of these materials must be present in the raw mix in an absolutely definite proportion in order to make a first quality of cement. There are several processes by which Portland cement is manufactured. The wet process, the semi-wet process and the dry process. In this country almost 95 per cent of the total product is made by the dry process.

One of the most modern Portland cement mills has been erected at Mason City, Iowa, by the Northwestern States Portland Cement Company. The annual capacity of this plant is about one and three-fourths million barrels. As any other great industry has undergone many changes and improvements, so has the Portland cement industry been improved by the adoption of economical machinery and the quality of the cement has been constantly improved through the advancement. There is no plant which does not employ a certain number of skilled chemists. The Northwestern States Portland Cement Company at Mason City is the seventh plant which the Cowham System has erected. The material used at Mason City by this company are limestone and clay which are found in almost perfect composition in the vicinity of this company.



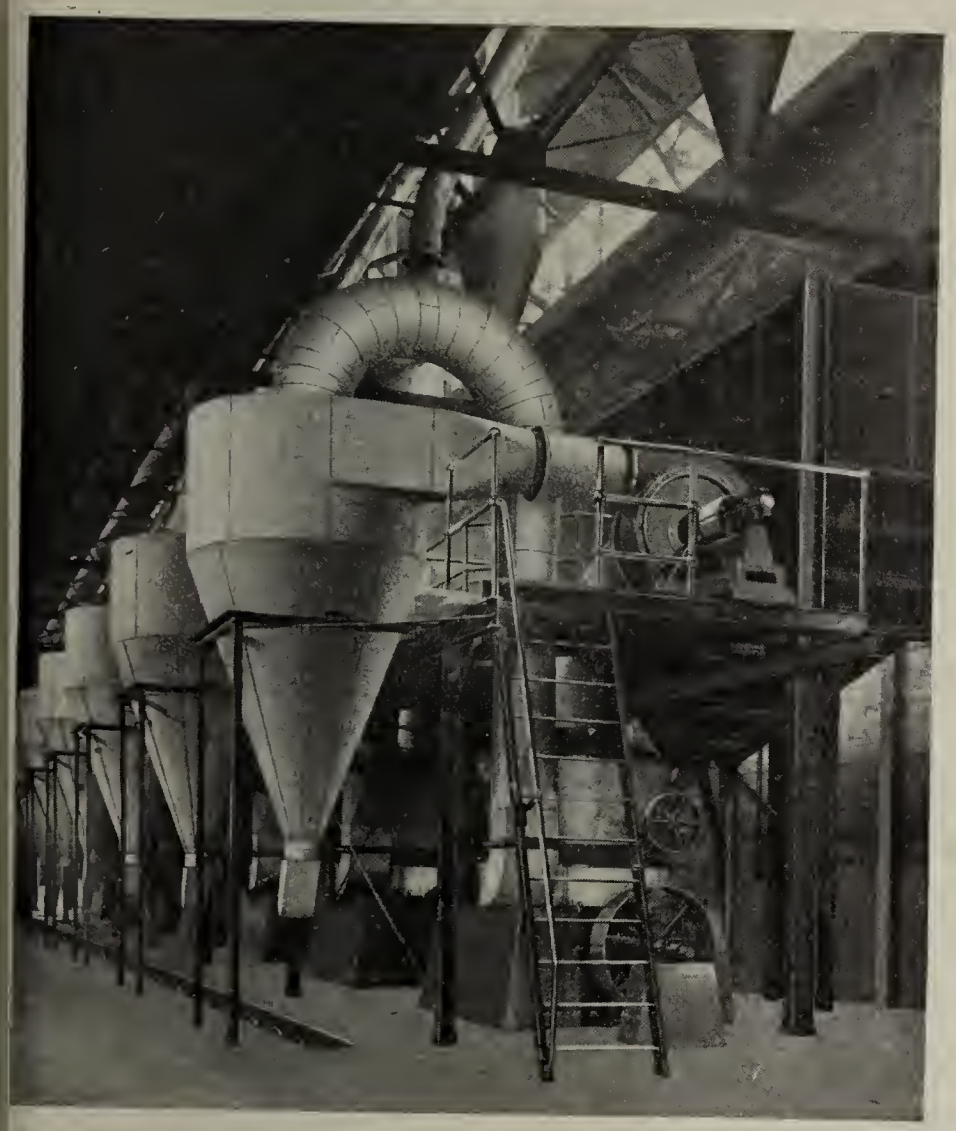
The Northwestern States Portland Cement Plant, Mason City, Iowa, Is the Seventh Which the Cowham System Has Erected. It has an Annual Capacity of About 1,750,000 Barrels and Represents an Actual Cash Investment of $2,700,000.

The quarry which is only a few hundred feet away from the plant has a limestone averaging about 97 per cent pure carbonate of lime of which many acres are owned by the company. The physical feature of this quarry is a very important feature. It has not only horizontal seams, but vertical seams at right angles to each other, and the seams are so close that the rock is in reality a lot of small cubes and very little blasting is necessary to tear these stones asunder. A large Marion steam shovel with a three yard dipper is used in loading this rock in side open cars and hauled by a "Shay" locomotive to the plant. The stone is dumped into a receiving hopper of a Gates gyratory crusher which crushes the rock to a four inch cube size, from where it is elevated to the top of the crusher building and crushed by two small Allis-Chalmers crushers to cubes about two inches and finer. The stone then passes from these crushers into a set of Allis-Chalmers crushing rolls which crushes the stone to about one-half inch size or finer. The stone is now discharged into the bottom run of a 24x32 inch Link Belt conveyor which encircles the stone drying, stone crushing and stone storage building like a belt. The stone storage building has capacity of about 30,000 tons of stone. The top run is located in the monitor of the buildings, and the bottom run is located in a tunnel under the storage pile. This conveyor permits the stone being carried directly from the rolls to the dryer bins or carried into the storage building. It is necessary to dry the stone before further reduction in size is made, which is done by two rotary stone dryers. The stone is fed out of the stone bins into the dryer by Gates Oscillating Feeders. These dryers consist of a cylindrical steel shell, six feet diameter by 60 feet long, mounted on two sets of carrying mechanisms. The dryers are set on a slight slope with the feed end a little higher than the discharge end. The furnace is located at the lower end, or discharge end, and the heat passes into the dryers and comes into intimate contact with the particles of stone, as the dryer is lined with fire brick and has shelves in it which raise the stone and shower it through the heated air and gases passing through the dryer.

From the stone dryers the stone is elevated and discharged into eight steel bins and from these bins discharged by means of a feeder into Krupp Ball mills. These ball mills take the output of the crusher above described and reduce it to coarse grit of about 50 per cent through a 100 mesh sieve. This mill consists of a drum having a diameter of about double its length, filled with 5,000 pound steel balls. The lining of the drum is made up of overlapping steel plates which form steps or shelves on the inside. This drum revolves at a speed of about twenty-six revolutions per minute. In the interior of this drum the rock is pulverized by means of a quantity of about 5,000 pounds of forged steel. The material in the mill after being crushed by these balls drops through screening plates and passes out of the revolving part of the mill. The stone is now about the size of sand, and the stone is now conveyed and elevated to the mixing station into a steel hopper, where it is mixed with the clay in proper proportions.

The clay fields are located about a mile and one-half southwest of the plant. No stripping is necessary as the clay is suitable directly beneath the grass roots.

A specially designed plow is drawn by a traction engine to plow this clay to the depth of about one inch. The clay fields are kept higher in the middle than at the edges in order to have easy drainage. By plowing up the surface as mentioned, the air and sun gets a chance to dry the clay and nature does the work of drying this clay out. The clay is gathered by means of a specially designed gathering machine on scrapers (revolving cylinders) each drawn by a team of horses. These gatherers load automatically and when full the team is driven over a bridge under which the clay track runs. The clay is dumped automatically through an opening in the bridge into the car and when a certain number of cars are loaded the train is pulled to the plant and on arriving at the mill the cars are placed on a tressle. Being Western side dump cars, a car load can be dumped in a few seconds. The clay is then, by means of a belt, discharged into clay pans where the grinding of the clay takes place by forcing this clay by heavy mills through a grate,



The Raymond Pulverizing Air-Separating System in Cement Plant.

discharging the clay into an elevated bin from which it is elevated and fed into the rotary clay dryers, to drive off all the moisture. These dryers are similar to the stone dryers. After the clay has been dried, the same can either be transported through the clay storage room or goes through to the mixing station into a steel mixer alongside the stone mixer. The clay storage has a capacity of about 15,000 tons of clay. There is another large clay storage building at the clay fields holding approximately the same amount.

In the meantime after these materials have been prepared, samples have been taken at every step at certain intervals and tested at the laboratory and the chemist knowing the composition of the limestone and knowing the composition of the clay, is now in position to give the proper amount to be mixed to obtain the proper raw mix. The stone is now ground to the size of fine sand in one bin, and the clay finely divided also in an adjoining bin. These bins are of steel and steel spouts lead the materials through shut-off gates to steel hoppers mounted on scales. There are two sets of scales, each of which is so arranged that the weighman can see the poise but cannot tamper with the weights, as the scale beams are in a box which is locked and the key held by the chemist on watch. The adjustment of these scales is tested very often by the chemist. The stone weighed first and then the clay is run in on top of the stone—approximately 9,000 pounds is weighed per batch. It is obvious that materials when reduced to this fineness and mixed in exact proportions by weight, pound for pound, give an exact and uniform mixture which is so essential to the manufacture of high grade Portland cement. After passing through a rotary mixer, which mixes this material is conveyed to the Allis-Chalmers tube mills for finer grinding and mixing. These tube mills are steel cylinders five feet in diameter by 22 feet long supported at each end by trunions. The mills are filled about one-half with flint pebbles about the size of one's fist. The mixture is ground to a fineness such that about 97 per cent will pass through a 100 mesh sieve. The mixer revolves about 26 times per minute. As the raw mix has now been prepared to its necessary fineness, it is conveyed and elevated to the kiln building, where the raw mixture is calcined, and after all the carbon dioxide is driven off, the acid and basic constituents are now fused, forming tri-calcium-silicates. The fusion takes place at about 2800° Fahrenheit. The clinker, as the mixture is now called, drops from the kilns into a pit and is conveyed by an Allis-Chalmers conveyor through the clinker cooling station. The kilns are similar in their construction to the stone and clay dryers mentioned heretofore, except that they are larger. These large horizontal cylinders are constructed of sheet steel 9-16 of an inch thick and lined with fire brick. The cylinder is supported at a slight incline from the horizontal, by means of rolled steel tires, each of which revolves on four heavy cast steel rollers mounted in pairs on a rocker. Each of these kilns, which were manufactured in Wilkes-Barre, Pa., by the Vulcan Iron Works, weighs, with its load of fire brick and charge of mix, approximately 175 tons. The kilns turn about one-half a revolution per minute. 1386—Cement News Tomm N21 otsr,dhfioax FOUR

A large amount of coal is used in these rotaries which, after being dried and powdered in Raymond Mills, has a fineness of about 97 per cent through a 100 mesh sieve—the same is conveyed to steel hoppers in the rear of the kiln building. The coal is then fed through a pipe into the lower end of a revolving cylinder at various speeds, and is blown with a pressure of four ounces per square inch through a five inch pipe into the kilns, producing perfect combustion to give the necessary heat to burn the clinker.

The cooled clinker is conveyed and elevated next to the Kent mill building where the clinker is reduced to the size of fine sand. This fine clinker passes over a series of screens separating the coarser clinker from the fine clinker. The fine clinker goes on to the gypsum station while the coarser is conveyed back to the Kent mill for grinding again. The finely ground clinker passes into a hopper having a capacity of two barrels to which a weighed amount of gypsum is added. There are two of these hoppers to allow feeding and discharging alternately. By this process, the addition of gypsum is uniform at all times, as the clinker is weighed and the gypsum is weighed, insuring perfect uniformity. The clinker with the addition of gypsum is then elevated and conveyed to the finish tube mills, which are similar to the raw mix tube mills. Here the clinker is ground to the desired fineness, which is on the average of about 96 to 97 per cent on a 100

mesh sieve. Tests of fineness of the cement are made from each mill every hour before the cement enters the warehouse. At this point samples of the cement are delivered to the laboratory each hour for the general tests of fineness, setting time and soundness. The warehouses in which the finished cement is stored has a capacity of 600,000 barrels. After the cement has been tested for the necessary tests already mentioned with the addition for tensile strength, the cement is then discharged from the warehouse bins into a conveyor running in a tunnel underneath the bins and elevated through to bins above the packing machines where the cement is packed in bags to be shipped out. Samples are taken again during the loading of each car of cement and tested again at the laboratory before the car leaves the yards. The samples of cement are kept on file for six months. Perfect records of shipments and tests are kept in the laboratory.

The entire building construction of the Northwestern States plant covers an area of about 40 acres of ground and the buildings on the plant proper are arranged in a unique order so that the material always advances from the crushing end through the various departments until it arrives at the packing room, where it is loaded onto the cars. About 1,600 carloads of machinery materials, etc., of construction (exclusive of sand, gravel and crushed rock) were used in the building of this plant.

The plant as it is here shown today represents an actual cash investment of $2,700,000.00, the daily capacity is 6,000 barrels of Northwestern States Portland cement. There are five trunk lines running into Mason City, making it an ideal shipping point, and enabling the Northwestern States Cement Company to make prompt shipments, which is, as you all know, one of the greatest items for such a large producer.

A BIG SAND CONVEYING PROPOSITION

In connection with the work of filling in with sand around the columns of the Field Museum, which is now being constructed in Grant Park at the foot of Twelfth street at Lake Michigan, Chicago, the contractors have devised a very extensive belt-conveyor system with which Sawyer Stitched Canvas belting is used.

To gain some idea of the magnitude of this work, it will be necessary to refer to the accompanying pictures which show fairly well the great lengths of belting that are being used.

When the work is completed, 600,000 cubic yards of sand will have been conveyed, all of which is carried some distance from boats. At the present time the sand is being conveyed by these belts a distance of 1350 feet.

In the choice of method of filling, tracks were out of the question, as there was no room to make turns, and then there was danger of shifting columns. The material already in place is soft fill and easily shifted.

To the north of the site about 700 feet is an east-and-west dock to which the sand boats have access. A harbor only 8 to 12 feet deep had to be dredged to give the 19-foot channels 90 feet wide. Near the shore two bins of 900-yard capacity each, with four compartments, were erected. The sand is pumped from the steamer Barth, which is equipped with two 12-inch Erie pumps. This boat was specially rebuilt for this job with three bins, 28x21x13½ feet deep, into the bins and the water drained off through vertical sluices on the side of each compartment. The other boat unloads upon a stock-pile over a 100-foot tunnel conveyor leading to the 30-inch main belt conveyor passing between the above bins. This conveyor runs south to the building, rising in the last 100 feet to the level of the finished fill at the top of the present concrete work. Here it is discharged upon a 30-inch wide conveyor, continuing south across the full width of the building.

A tripper on this belt discharges upon a transfer conveyor running to the west wall. Both of these belts are mounted on the concrete columns, but the transfer line starts at the north wall and is moved over its own fill toward the south. The successive stations will be 21 feet apart, or in the center of the light bays and on the tops of the seven lines of columns and on the north and south walls.

The tripper on the transfer belt has a 36-inch shuttle conveyor belt overhanging a maximum of 18 feet on either side. The 40-horsepower motor for driving the transfer belt is located at the west end and is connected by a clutch and reducing gears to a winch for winding up the belt before moving the track on which

The Belt Conveyor System Designed and Erected by the Raymond W. Dull Co., Chicago, for Conveying Sand in Building the New Field Museum, Chicago.

the shuttle and tripper run. The winch is also for use in pulling over the sand the 14-foot sections of track, which are mounted on plank sleds.

The shuttle mechanism and the tripper moving along the transfer belt are driven by the transfer belt itself.

In moving the transfer conveyor to the next station the shuttle tripper is driven up close to the receiving end near the tripper on the main belt on to a trussed bridge with a span reaching to a track laid on the first line of piers to the west. Both trippers can then be moved south the required distance to the new position of the transfer belt.

Two boats bring the sand used for filling from the Michigan or Indiana shore, as little sand dredging is available in shallow water on the Illinois shore. The limit in depth for the suction is about 25 feet. The steamer Hydro is equipped with two 12-inch Morris dredge pump. It has two 500-yard bins, and unloads by means of two derricks with 2-yard Ruddock clamshell buckets delivering into a small central hopper feeding a belt conveyor on a 72-foot boom, which discharges the 1000-yard load on to the stock pile in three to five hours. The stock pile provides leeway for both the boat and the conveyor system, the latter operating

at about 250-yard capacity per hour. This boat makes one trip to the Michigan shore daily, and requires from three to four hours to load.

Sawyer stitched canvas belting is used exclusively on this job.

PURIFICATION OF BOILER FEED WATER

The softening and purification of boiler feed water is a chemical process which, to insure the best possible results, must be done with accuracy and the process carried on uniformly so that the water after softening and purification will be of a constant degree of softness with the hardness reduced to a minimum. The amount of impurities which a water contains is not always a criterion of its suitability for boiler feed water for there are many cases where waters containing only small amounts of scale-forming impurities are still the cause of much waste and expense in boiler operation.

The evaporation of water into steam which is constantly flowing from the boilers results in the continual concentration of the impurities introduced with the feed water. Nothing but the volatile impurities and pure water as steam leave the boiler when the boiler is generating dry steam; consequently, there is a constant increase in the amount of impurities in the water remaining in the boiler, the result of which is apparent as suspended matter, scale, corrosion, and increased density of the boiler water.

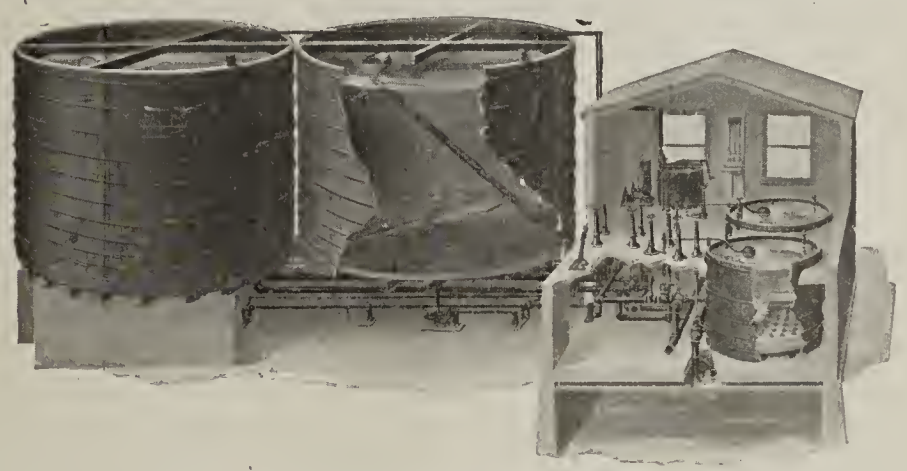
With a boiler feed water that is properly softened and purified it is possible to operate boilers year in and year out without scale or corrosion and without deposits in heaters and pipe lines. Scale cannot form even with indefinite concentration for the small amount of lime and magnesia salts left in the water are of such a character that when precipitated as the result of concentration in the boiler, only a very slight sludge is formed, which can be kept at a minimum by proper blowing off, and no matter how long the boiler is in operation, on being opened it will have the appearance of having been white-washed. By washing out with a high pressure and rubbing with the finger, the metal of the boiler can be exposed to view. Corrosion does not occur because when the water is properly softened and purified it does not contain either corrosive acid, or substances which in the boiler could produce such acids.

The water softening system here illustrated is the We-Fu-Go intermittent system, built by Wm. B. Scaife & Sons Company, Pittsburgh, Pa. This system consists essentially of two or more reaction and settling tanks equipped with mechanical stirring devices operated by power; a small reagent mixing tank with means for introducing reagent solutions from it into the reaction tanks; and a mechanical gravity filter.

The reaction tanks are filled alternately with water. While a tank is filling, the reagents are introduced and thoroughly mixed with the water by means of the mechanical stirring device. After a tank is filled and reagents stirred into it, the stirring device is stopped and the water permtited to stand to allow the precipitated impurities to settle to the bottom of the tank. The softened water is drawn out of the tank by means of a hinged floating outlet pipe arranged to rise and fall with the flow of the water, so that the water is always drawn from the top. The water at the top being the clearest carries the least amount of floating sludge through the outlet pipe to the filter bed. The rate of flow from the settling tank to the filter is automatically controlled, so that the filter is supplied with water as fast as it is drawn from it.

Either pressure or mechanical gravity filter may be used. While one reaction and settling tank is being filled, treated and settled, the other is supplying purified water, and by the time it is empty the first tank is ready to use. In this way a constant supply of accurately softened and purified water is always available. The pipe connections through which to fill the tanks and through which to wash the sludge from the tanks, are placed in the bottom. The washing of the settling tanks is accomplished by opening the valves to the sewer and starting the stirring device to mix the sludge, which is soft enough to flow through the pipe into any sewer.

This system is modified in design to meet the specified requirements in each case, taking into consideration the purpose for which the water is to be used and the kind of water to be treated. This system includes all of the elements to provide for proper mixing of reagents with the water; accuracy in measuring reagents to the requirements of the water; ample time for chemical reaction and for the settling of precipitate; and final clarification by mechanical filtration. The rate at which the water is drawn from the system does not affect results. The operation of this system is the same as the method followed by the chemist in the laboratory, but on a larger scale with minor modifications.



Part Secctional View of a Large Water Purifying System as Used in Connection with Power Plants.

The use of two or more reactions and settling tanks makes possible an accurate daily record of the amount of water evaporated in the boilers. This feature will be appreciated by careful managers of large plants who wish to keep close check on fuel consumption. In most cases the apparatus can be operated by the engineer, or his assistant without interfering with his regular work. The degree of softening and purification obtained is practically constant regardless of the character of the raw water; that is, the reduction in scale-forming substances is uniform and constant whether the water being softened and purified is obtained from well, creek, river, mine or a mixture of supplies.

Electrically Driven Haulage, Belt Conveyors, Screens and Crushers, Operated in Conjunction with a "Lidgerwood" Drag Line Excavator Also Electrically Equipped, at Niles, California. The Property of the Niles Sand, Gravel & Rock Co.

Sand and Gravel Deposits of the Niles Sand, Gravel and Rock Company

Entire plant is operated by electric power. The plant in ordinary working days produces thirty car loads per day.

An interesting as well as successful plant is taking large quantities of sand, gravel and rock from a gravel bed near the town of Niles, in Alameda county, California, to aid the purposes for which such material is used in various places, such as road, bridge and building construction, or wherever concrete is used for any purpose. The process is very unique and successful and represents a total investment of about two hundred thousand dollars ($200,000).

The Niles Sand, Gravel & Rock Company was placed in operation in the summer of 1912.

The Alameda creek at Niles is quite wide, and the bed is filled with a deposit of sand and gravel washed down from the hills by the heavy rains of many years. There are also some very large bowlders. The sand and gravel must be washed out, the sand separated from the gravel and the gravel itself separated by means of large revolving screens into the various sizes that are commercially valuable. Those that are too large are run through a 36-inch Symons disc and No. 5 Gates crushers and make a very fine grade of crushed rock.

There is a large Lidgerwood dragline excavator operated by electric motors. This excavator runs on rollers, and by means of the long boom gathers the material and deposits it in the cars that carry it up the inclined cable railway where it is dumped into a hopper and fed on to a belt-conveyor that takes it to the top of the plant. The motor installation on the excavator consists of a 112-horsepower Westinghouse motor to operate the dragline bucket, a 22-horsepower motor for revolving the excavator and two small motors of six horsepower each, direct connected to air compressors to furnish air to operate the brakes. This excavator when put in service was the first of its kind to be operated with electric power. It was manufactured by the Lidgerwood Manufacturing Company, of New York and Chicago.

A general view of the plant shows the inclined railway hoist, the hopper and belt-conveyor to the top of the crushers. The large storage bins are in the rear and are better shown in the picture, which also shows the railway track from the main Southern Pacific line and the method of loading by gravity from the large bins. The loaded cars of material are hauled up the incline by a steel rope around a drum, the power for which is furnished by a 75-horsepower Westinghouse motor. The belt-conveyor consists of a conveyor-belt thirty inches wide, and is also operated by a 75-horsepower Westinghouse motor.

When the material, sand, gravel and rock has reached the top of the main plant those rocks over 2½ inches are passed down to the 36-inch Symons disc and a No. 5 Gates crusher and reduced to a proper size. The balance of the material is carried across to the top of the bins, the dirt is washed out by means of two large streams of water through nozzles and the sand separated from the gravel which in turn is run through ten long Jeffrey revolving screens to get the exact sizes for the proper bins, and all sizes are again washed with clean, fresh water under high pressure in each of the ten screens; and the sand is washed in four additional sand-washing boxes, making a concrete or topping sand of the very best quality. After the material has been carried to the top of the plant by the belt-conveyors, the other movements, including the loading of the cars, are accomplished by means of gravity.

There are two crushers to handle the bowlders and

rocks that are too large for commercial purposes and reduce them to crushed rock of a proper size—a 36-inch Symons disc crusher of a capacity of seventy tons per hour that handles all that will pass through a 4-inch opening, and a No. 5 Gates gyratory crusher of a capacity of fifty tons per hour that handles those of a larger size. Each crusher is operated by a 50-horsepower Westinghouse motor. The material from the two crushers is carried back by a belt-conveyor twenty-four inches wide, which is operated by a 15-horsepower Westinghouse motor, and dumped on the main conveyor, so that the crushed rock is thoroughly mixed in with the uncrushed and the mixture makes a particularly good grade of concrete material. The water for washing the material is pumped from fresh water wells adjacent to the plant by means of a 1,000-gallons-per-minute Erie centrifugal pump operated by a 50-horsepower Westinghouse motor, and an interesting thing in connection with this pumping plant is that the water, after having been used to wash the material before it goes to the bins, is used to irrigate many orchards on lands adjoining the plant. This forms an interesting example of conservation.

The entire plant, with the exception of the two Ohio locomotive cranes which are used for switching cars and with the 1⅝-yard Ruddock clam-shell bucket is also useful in loading cars from storage piles, is operated by electric power, there being motors of a total capacity of over 500 horsepower installed.

The vast amount of storage, consisting of over one thousand carloads of washed, crushed and segregated materials, is principally drawn from during the winter months, this being loaded for shipment by a locomotive crane. The modern equipment of the plant, coupled with this storage system, gives to the consumer a perfect service. These storage piles are of correctly sized materials for all classes of work, including concrete aggregates for buildings, bridges, road construction, roofing and paving purposes.

CLINKER GRINDING TEST

Following is a result of the tests obtained on clinker grinding at our works with Bradley Hercules Mills, manufactured by Bradley Pulverizer Company, Boston, Mass.:

One test run was made covering a period of 1,743 hours, using an 8x8-inch No. 13 wire screen, giving us an average output of 130 barrels per hour, or a total of 226,590 barrels.

Clinker was taken direct from the piles and fed into the mill, giving us a fineness of 50% to 55% passing the 100-mesh, and 43% passing the 200-mesh, with a power consumption of 175 h.p.

During this test we used two die rings, two sets of roll heads, also two sets of shafts and bushing. These shafts, of course, can be used a second or third time by turning them down, making a new bushing to fit them, thereby saving considerable cost of repairs.

The average repair cost of material and labor per barrel ground was $0.0041 for this period of operation.

Since that test we have operated over a long time with a 6x6-inch mesh No. 14 wire screen, giving us an average output of 200 barrels per hour with 175 h.p., with a fineness of 39.5 on the 100, and 25.8 on the 200, and an average repair cost per barrel of $0.0036.

I might further state that we have never had a break down of any kind on these mills since putting them in operation, the only time lost being when the mills would be closed down to put in new roll heads and base tires. The cost of operation has remained practically the same as stated for these tests. Yours truly, F. F. Parker, Supt., Riverside Portland Cement Company, Riverside, Cal.

THE WORKER AND THE WORKS

"The Worker and the Works" is the title of a booklet describing the history of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Special chapters deal with safety devices at the shops, the Shop Magazine, the Westinghouse Club, the Technical Night School, relief work and pension plans.

Lidgerwood Electrically Driven Drag Line Excavator at the Plant of Niles Sand, Gravel & Rock Co.

Large Products Plant in Successful Operation in Chicago

One of the Two Main Working Sections of the Plant, Showing Machines in Center and Curing Rooms to the Right.

One of the most extensive plants for the manufacture of concrete products in the middle west is now in operation in that part of the Chicago territory known as Clearing. This locality gets its name from the fact that it is a territory where clearing yards have been developed for the transfer and forwarding of freight, so that it naturally furnishes unusually good shipping facilities. It is, therefore, an ideal location for the development of a large plant, the bulk of whose production can be sent out over the railroads rather than delivered locally.

The plant is operated by the Hydro-Stone Products Company, formed largely of the same individuals who comprise the Hydro-Stone Company, 259 Insurance Exchange building, Chicago, and who control the Hydro-Stone system of concrete products manufacture. The principal distinguishing characteristic of this system is that each unit is subjected to a pressure of 150,000 pounds before it is taken from the machine, giving it a very low percentage of absorption.

The plant and storage yards occupy about two acres of ground. The main building is 120x200 feet in size; the outer walls consist principally of pilasters supporting the roof, the space between them being filled with sash glazed with plain glass. As the walls are 14 feet high, these windows, together with several skylights, admit a sufficient quantity of light to carry on the operations of the plant at all times except the most unfavorable weather.

The plant is at present running nine machines, as shown on the floor plan. A rather unusual design has been adopted of having some of the curing rooms inside the main part of the plant. These occupy a ground space in the center of about 50x80 feet, divided into eight kilns, each carrying two tracks with steam coils between them. These curing rooms do not, of course, run the full height of the building, being covered over at a height of seven feet. They have upward-swinging doors, and the steam coils are arranged so that the perforations for discharging the steam into the kilns are carried in a long return section of pipe, the main section of the pipe which comes direct from the boiler having no perforations. The two are separated by a stop-cock so that steam for warming can be turned into the pipe if desired, without having steam escape into the kiln. Care is taken to shut off the steam in a kiln some hours before it is to be opened, thus doing away with the main objection of interior curing rooms, that of having steam escaping into the main work room.

Additional curing space is also provided in eight kilns outside the building, each carrying three tracks and occupying a space of 50x100 feet.

The boiler room is in a separate building to the south of the plant, housing a 100-horsepower Murray boiler. This is used for curing purposes, and will be used also for heating in the winter, but electric motors are used for operating.

The materials are taken in directly from the cars, the siding running along the east side of the plant. They are mixed in a ½-yard Oshkosh mixer and delivered to the machines by wheelbarrows as needed.

The plant also includes a large business office, private office, draughting room, pattern making department and a modeling room.

Two Methods of Delivery to Railway Cars—By Industrial Cars and Gravity Conveyors.

A Half Yard Mixer Supplies the Concrete.

Blocks Handled by Gravity Conveyor.

Storage Yard with Outside Curing Rooms in the Background.

A considerable part of the work of the plant consists of special forms, odd sizes of blocks, ornamental pieces, and cast-stone trim. A large part of this work can be done on the Hydro-Stone machine, but some of it, especially the larger pieces, are cast in specially made wood forms.

The finished product is delivered to the railway cars in two ways; either by industrial cars, and the loading done by hand, or else by means of Mathews gravity conveyors. The equipment of the plant includes a number of lengths of these conveyors, both straight and curved. In addition to loading cars, they are used in a number of other ways for handling blocks about the plant.

The working force at the plant is made up about as follows: One superintendent, two foremen inside the plant, one yard foreman, 50 men on machines, 4 men mixing and delivering concrete, 3 draughtsmen, 3 pattern makers, 2 modelers, 8 men loading cars, 1 fireman, 1 bookkeeper and stenographer, 1 night watchman.

Storage Yard and One End of Building, Showing the Adequate Lighting.

West Working Alley, Showing Track to Outside Curing Rooms.

THE "BOSS" CONCRETE MIXERS

The American Cement Machine Company, 9635 Johnson street, Keokuk, Iowa, has issued an attractive catalog entitled "Specifications," which relate to the leading lines of concrete mixers turned out by this concern. Special reference is made to the "Boss," which embodies a high speed "Re" mixing action which it is claimed mixes and discharges the concrete faster than is usually the case and with fewer drum revolutions. It is claimed that a batch may be mixed in 15 seconds and discharged in from 10 to 15 seconds, owing to the fact that the discharge spoon extends nearly two-thirds the way through the drum and every one of the deep scoops or buckets discharges into it. The claim is also made that the machine will mix concrete, grout or semi-dry mortar and plaster. It is practically self-cleaning, and its constructive features are such as are likely to interest contracting-builders generally. It is made in sizes and styles to meet varying requirements and in the catalog in question full information concerning the salient features is set forth. Attention is also called to the "Boss" hoisting attachment, and to watering devices for concrete mixers. A page of the catalog is given up to detailed tables of capacity and weights of "Boss" mixers; also diagrams showing the general dimensions.

THE RUGGLES AERIAL CARRIER

The illustration on this page shows the Rugged Ruggles aerial carrier in operation at the plant of the Swanton Lime Works, Swanton, Vt. This carrier has given excellent service here and is used in a very unique fashion to a very good advantage at a low cost of operating and low cost of installing.

The Ruggles aerial carrier is self-dumping, self-braking and self-locking and is built in two sizes, one to five tons capacity and five to ten tons capacity.

It is made for special use on cement and gravel construction work. For all kinds of quarries where the waste is taken from the pit and dumped at the surface. It will take any load up to ten tons, from any depth to the cable, where it is automatically released and sent either up or down the cable and dumped in mid-air or lowered. One man can operate three Rugged Ruggles on as many cables with a three-drum engine. There is no brake to wear the cable—can run on a flat cable. It is simple in construction and made entirely of steel; all the sheaves steel bushed or brass, and is backed by years of extensive use. Manufactured by Ruggles Machine Company, Poultney, Vermont.

The Ruggles Aerial Carrier in Operation at the Swanton Lime Plant.

FULLER-LEHIGH PULVERIZER MILL HAS NEW CHICAGO OFFICES

Owing to the rapidly increasing pulverizing business of the Lehigh Car Wheel & Axle Co., this firm has opened an office at 1336 McCormick building, Chicago, in charge of Harry C. Shields. The pleasing personality of Mr. Shields, together with the high esteem in which the company is held by the trade, is indicative of the fact that the latchstring, which was placed on the outside of the door on Sept. 25, will be often used to gain admittance. The office will also be used as the western headquarters of the Fuller Engineering Co. and the Lehigh Stoker Co., both of which concerns will be represented by Mr. Shields. An office has also been opened in Pittsburgh under the management of J. H. Schuler with headquarters at 706 Farmers Bank Building.

O. E. THALEY CHICAGO MANAGER POWER & MINING MACHINERY CO.

Mr. O. E. Thaley has been appointed district manager of the power and mining department of the Worthington Pump & Machinery Corporation with offices at 825 Old Colony Building, Chicago. He will have charge of the sales of McCully gyratory crushers and Superior jaw crushers in the states of Ohio, Indiana and Illinois.

Mr. Thaley has been identified with the sale of crushers for a great many years and has a very wide acquaintance among cement, crushed stone and gravel producers the country over.

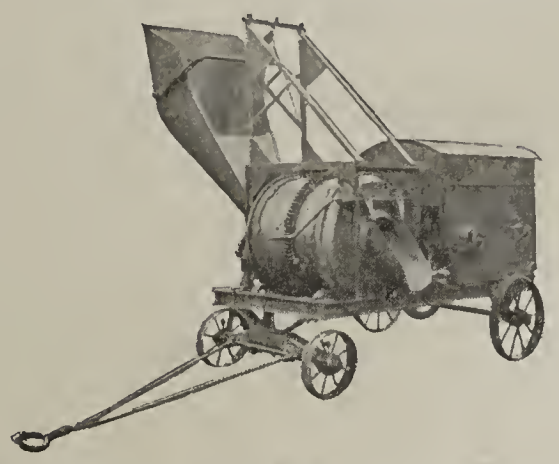
STOP YOUR LABOR WORRIES
WITH A
Haiss Digging Wagon Loader
(PATENTED)

There are a hundred ways in which this labor saver can meet special loading or car unloading conditions. but managers must write us about their problems first, then we will show them a solution. Don't wait. We have surprised many concerns with the wonderful possibilities that may be accomplished by this loading machine. Our machines are increasing output and reducing labor on hundreds and hundreds of shoveling jobs. Equipped with gasoline or electric motors. Operating cost one-half to one cent per ton; loading speed one ton per minute. Write today for prices.

The George Haiss Mfg. Company, Inc.
143rd St. and Canal Place New York City

LANSING FIVE

—Rotary Pump
—Side Loader
—Ideal or Novo Engine
—Gear Driven
—Folding Platform



—Silo Hoist
—Batch Hopper
—Water Tank
—High Wheels
—Wagon Tread

THIS MIXER MUST EXCEL

It has been a positive necessity for us to make the Lansing Five the best mixer in the world at anywhere near its price. We went into the business of making mixers knowing that the field already was well filled, that many concerns were making good mixers and selling them at reasonable prices. But, backed by a great thirty-five year old concern with a paid-up capital of $1,500,000 and a world-wide reputation, we entered the field with a reputation and standard to uphold, not with a reputation and standard to create. So, obviously, we had to build a mixer which would stand head and shoulders above everything else in its class. We were forced to make the Lansing Five excel —AND IT DOES.

LANSING COMPANY
"KEEP YOUR PRODUCT ON WHEELS"

Write for Catalog 354-M

LANSING :: MICHIGAN

WAREHOUSES:
CHICAGO, 169 W. Lake Street — MINNEAPOLIS, 517-519 N. Third Street
NEW YORK, 288-289 West St. — PHILADELPHIA, N. American & Willow
KANSAS CITY, 1413-1415 W. 10th St. — SAN FRANCISCO, 338 Brannan St.
BOSTON, 78 Cambridge Street, Charlestown Dist.

High-Grade, *Low*-Priced Drum Mixers

Backed by Austin Engineering

When it comes to volume, rate and quality of output, working life, low maintenance cost and simplicity of operation, we invite your most rigid inspection of the design, construction and performance records of

Austin Drum Mixers

Discharge Side of No. 1 Austin Drum Mixer

The charging arrangement is a hinged funnel-shaped steel plate hopper, which when lowered can be filled at ground level from barrows. For discharging into the mixing drum the hopper is elevated by a simple cable hoist.

A hand lever operates the swinging discharge chute. During the mixing operation the chute is set in such a position as to avoid any possibility of catching and discharging portions of the batch, yet by a simple manipulation of the chute the whole batch or any portion can be discharged at one time. All operations are controlled from one position.

Equipped with hopper cooled gasoline engine in steel housing. Capacities 4½, 6½ and 10 cu. ft. of mixed concrete.

MEMBER OF NATIONAL ASSOCIATION OF MIXER MNFRS.

Our Mixer Capacities Based on N. A. M. M. Wet Batch Rating

Municipal Engineering & Contracting Co.

Main Office: Railway Exchange Bldg., Chicago, Ill.

New York Office: 30 Church Street
New England Agents: Dyar Supply Co., Cambridge, Mass.

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Municipal Engineering & Contracting Co.
Railway Exchange Bldg.
Chicago

Send me catalog No. 21-D. I want to know more about high-grade, low-priced drum mixers and pavers made by the builders of Austin Improved Cube Mixers.

Name.....

Address.....

.....

IMPORTS AND EXPORTS OF CEMENT (ROMAN, PORTLAND AND OTHER HYDRAULIC) DURING AUGUST, 1916

Imports

Districts—	100 lbs.	Dollars
Maine and New Hampshire	22	14
Alaska	18	133
Michigan	438	181
Vermont	760	311
Total	1,238	639

Exports

Countries—	Barrels	Dollars
Belgium	25	74
Bermuda	710	1,040
British Honduras	126	186
Canada	2,774	4,306
Costa Rica	3,095	5,980
Guatemala	607	1,015
Honduras	1,567	2,679
Nicaragua	1,531	2,782
Panama	625	880
Salvador	2,797	4,894
Mexico	2,489	5,346
Miquelon, Langley, etc.	50	105
Newfoundland and Labrador	2,150	2,891
Jamaica	1,540	2,526
Trinidad and Tobago	4,270	6,350
Other British West Indies	1,519	2,471
Cuba	71,136	110,207
Dutch West Indies	2,810	4,529
French West Indies	750	1,200
Haiti	5,838	8,228
Dominican Republic	2,011	3,279
Argentina	100	145
Brazil	24,473	33,201
Colombia	865	1,287
Ecuador	815	1,350
British Guiana	1,200	1,845
Dutch Guiana	1,250	2,000
Peru	1,145	1,561
Venezuela	2,795	4,017
China	3	9
British India	10	35
Dutch East Indies	65	98
Australia	20	30
New Zealand	60	80
Philippine Islands	18	27
Egypt	3	5
Total	141,242	216,658

RATES ON SAND PROTESTED

The Portage Silica Company of Youngstown, Ohio, has lodged with the Inter-State Commerce Commission a complaint against six railroads, alleging damaging discrimination in respect to transportation of sand and gravel from the banks at Phalanx, Ohio, to the Pittsburgh district.

Complainants are extensive shippers of sand and gravel into the Pittsburgh district, particularly molding sand, but claim to be losing business here in considerable volume by reason of the 84-cent freight rate now imposed, which is an advance of 10 cents per ton over that formerly obtaining, the increase having been made by the Erie Railroad, on whose line the Phalanx sand and gravel banks are located, and being equivalent to 13½ per cent. Cleveland concerns engaged in the same line of production have secured a decided advantage by reason of more favorable freight rates.

Residence of Mr. Al. Bryan, Creston, Iowa, Showing High Grade Block Construction.

CONCRETE BLOCKS THAT MEAN NEW BUSINESS AND INCREASED PROFITS

Poured concrete building blocks, manufactured by Merrill Moore, Creston, Iowa, with a facing of Medusa white Portland cement, embody the best qualities of other building materials—beauty, strength, adaptability and durability.

The illustration is of the residence of Al Bryan, Creston, Iowa, and plainly shows what can be accomplished in high-grade block construction. White granite was used as an aggregate with Medusa white cement, and the manufacturers advise that blocks of this kind sell when placed in competition with pressed brick and cut stone.

ERIE CENTRIFUGAL PUMPS

Catalog No. 32, superseding Bulletin No. 31, has just been received from the Erie Pump & Equipment Company, Erie, Pa. In it are described and pictured in detail Erie, class M, volute centrifugal pumps, which are furnished in five styles, as follows:

(1) Single suction horizontal.
(2) Double suction horizontal.
(3) Single suction vertical.
(4) Compound horizontal.
(5) Multi-rotor double suction.

Erie centrifugal contractors' and general service pumps are also described in bulletin No. 23. Both catalogs are gotten up in a form to be of ready reference to buyers.

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CHICAGO

VOL. 28 DECEMBER, 1916 No. 12

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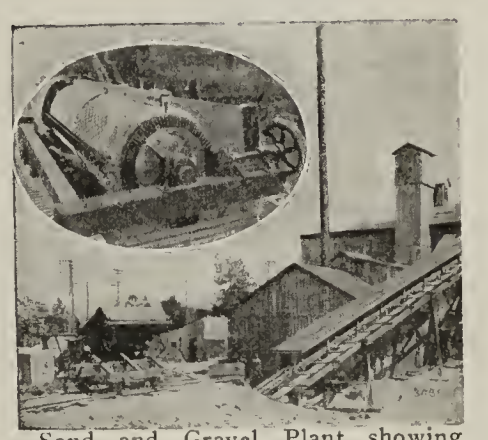

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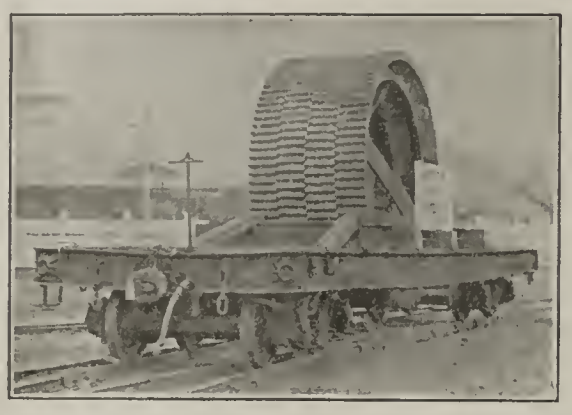

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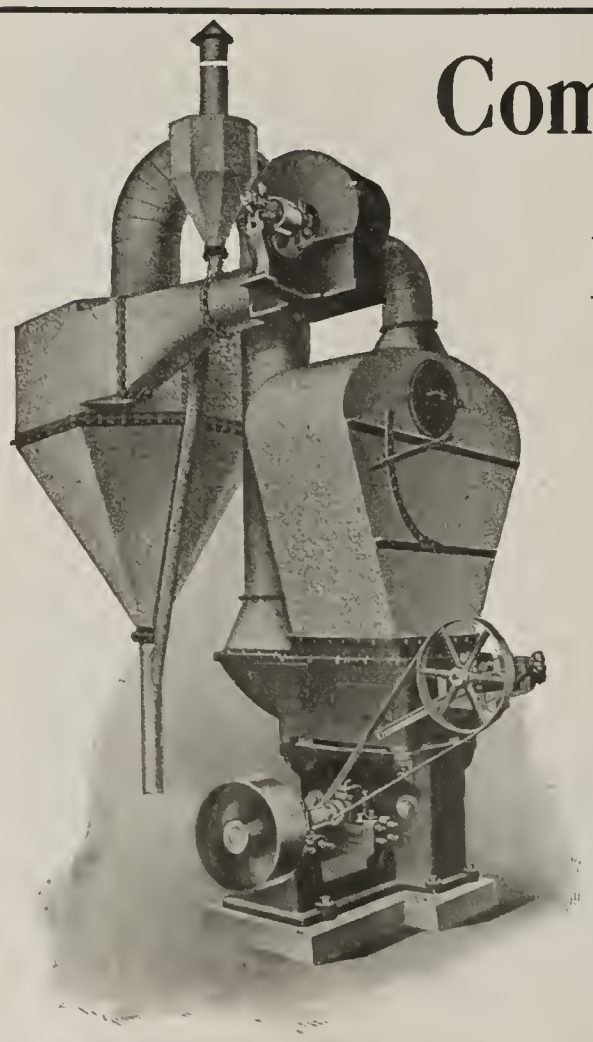

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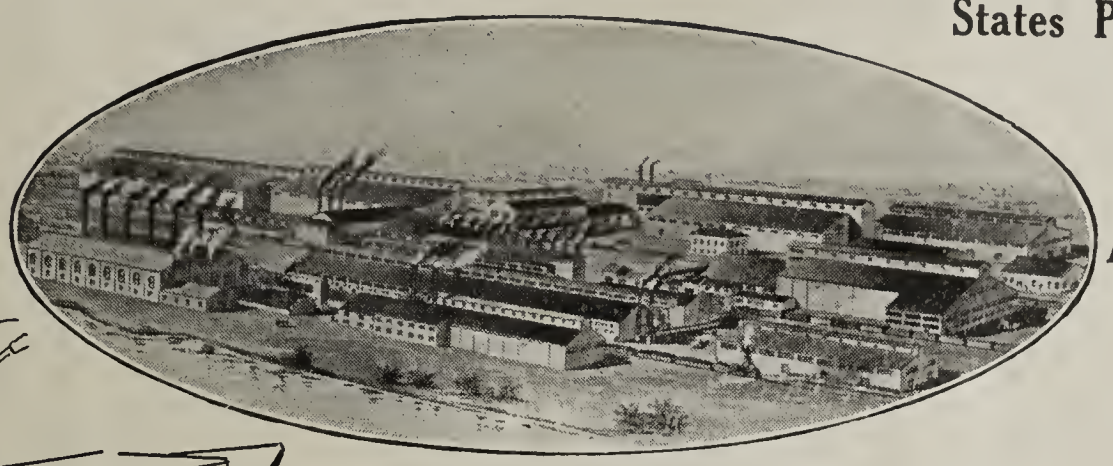

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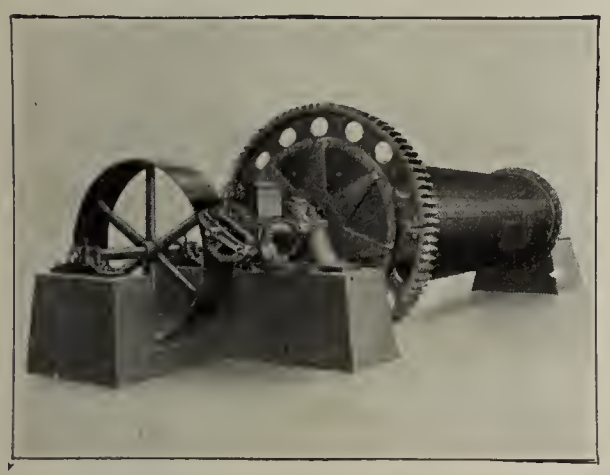

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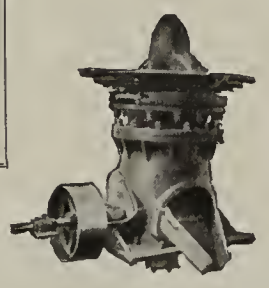

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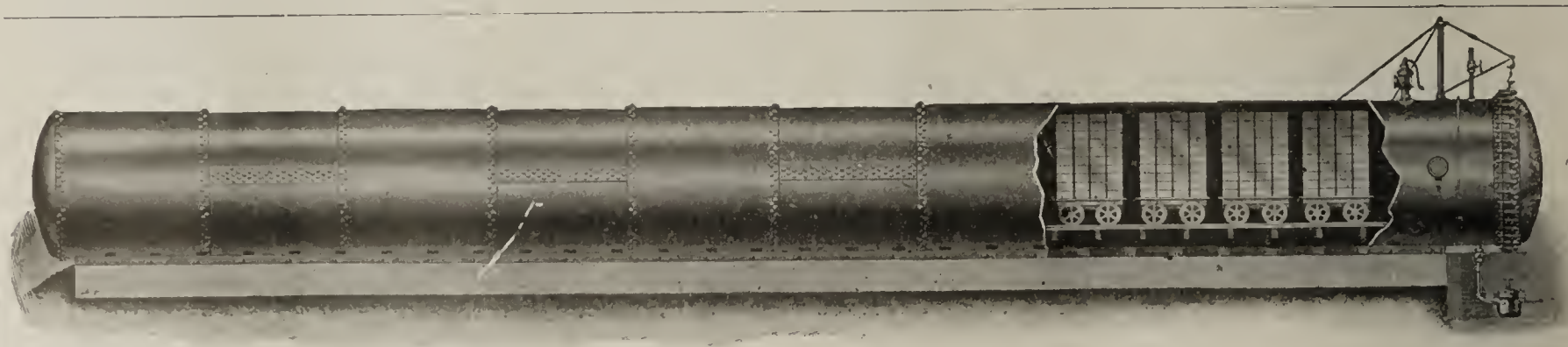

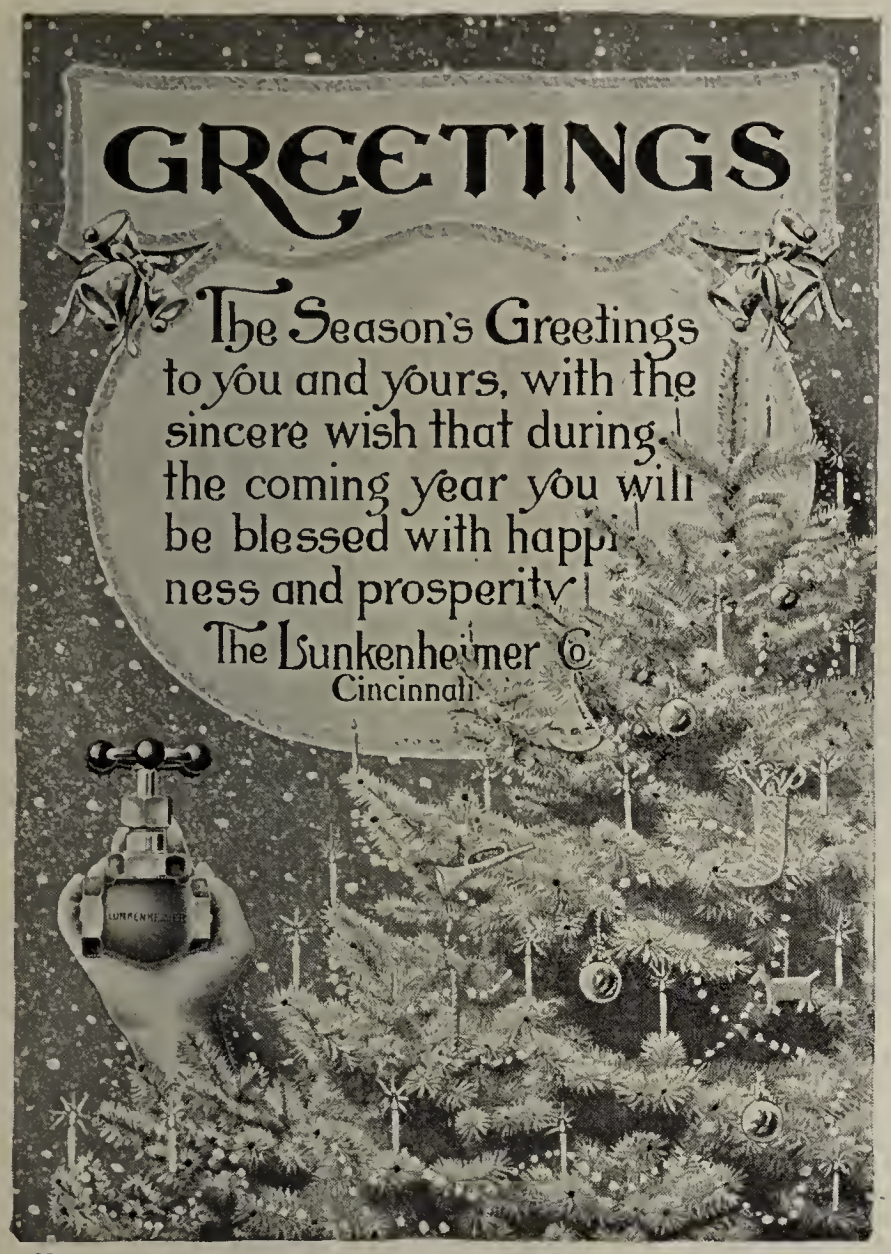
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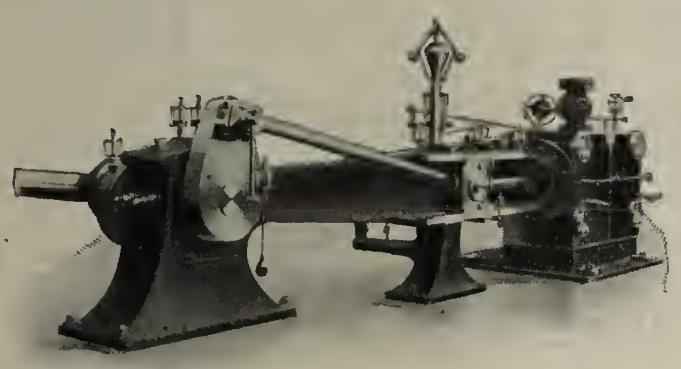

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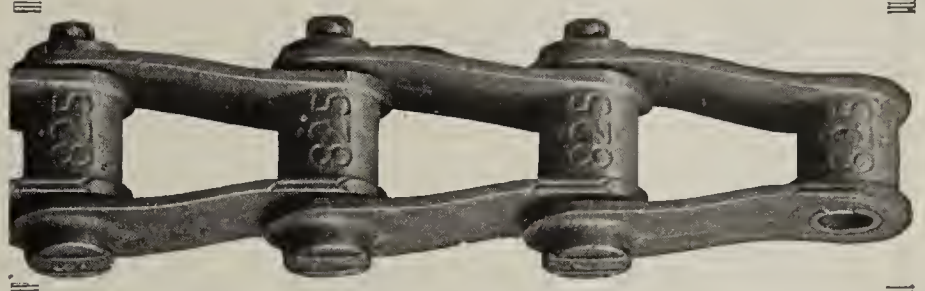

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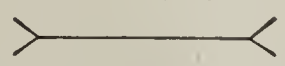

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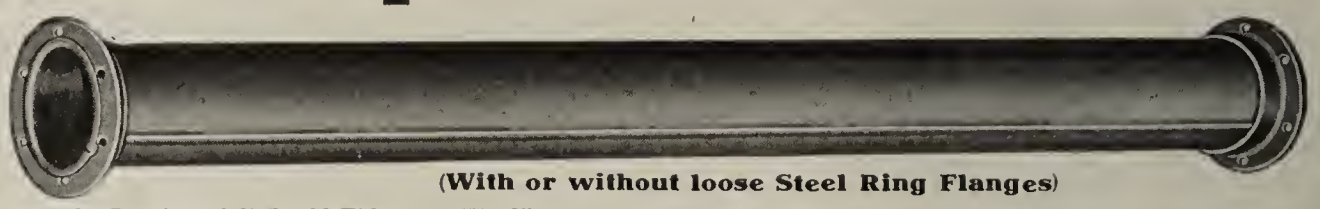

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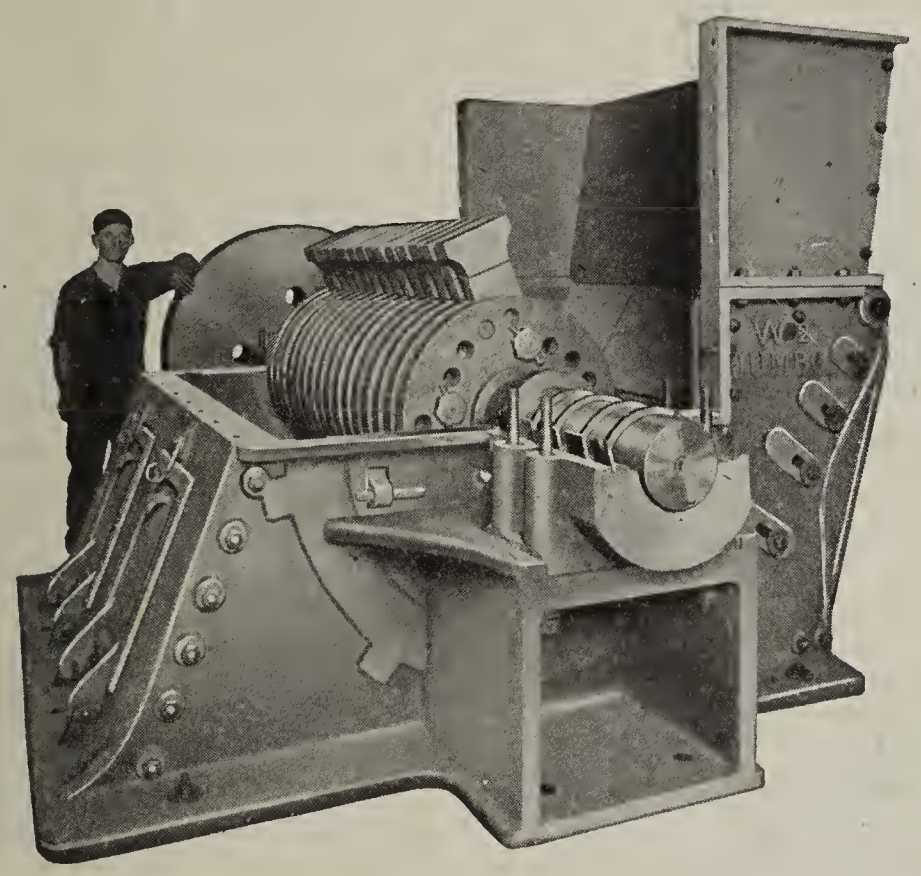

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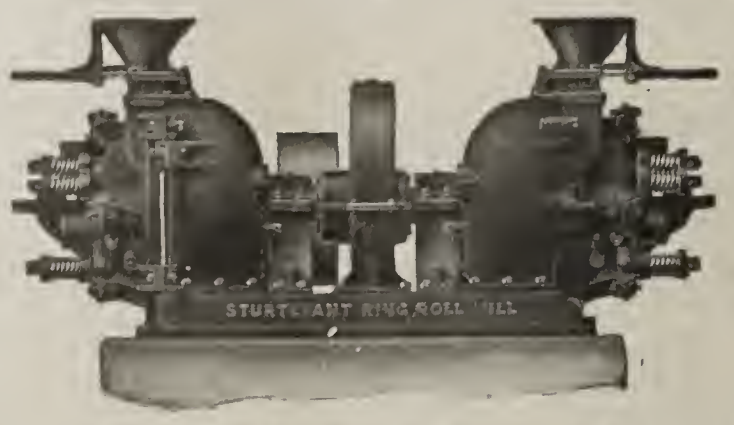

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50 " 60 " " 80 " " 80—90 H. P.

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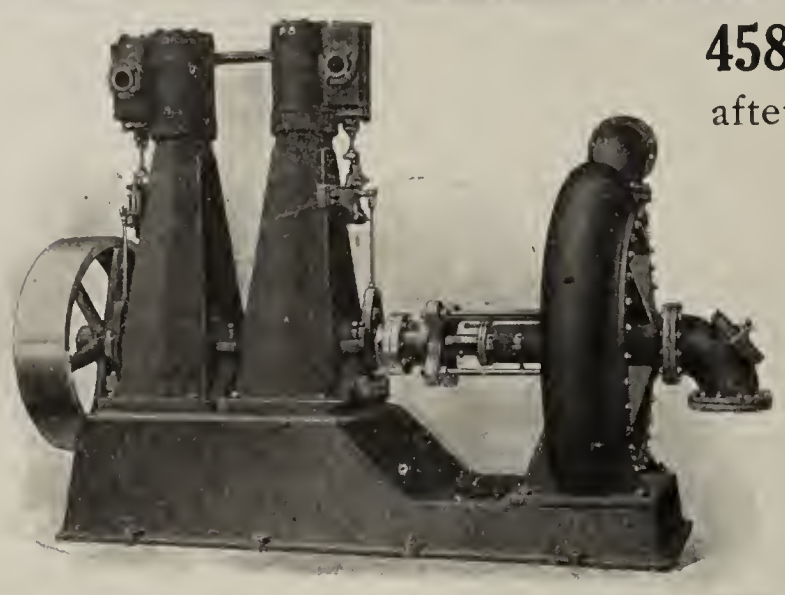
The Ring-Roll Tube Mill Unit can produce cheaper cement from every standpoint — upkeep capacity, low power and continuous operation than any other. Ask the users, they can prove it to you, and we can.

SEND FOR CATALOGUE

STURTEVANT MILL COMPANY - BOSTON, MASS.

NEW YORK PITTSBURGH CHICAGO DENVER LONDON, ENG'



458 Cu. Yds. of Sand and Gravel Per Hour

after twelve years of service is the actual output of one standard 12 inch.

Erie Sand—Gravel—Dredging Pump

The original cast iron shell gave seven years' service. The renewed shell is still in use. The original cast steel runner is good for at least three more years.

Compare this performance with that of an ordinary sand pump.

Why not let us submit a proposition that will save you many dollars each year? There is no obligation. Write us today.

ERIE PUMP & EQUIPMENT CO., Erie, Pa.

A CORDEAU-BICKFORD S HOT

CORDEAU-BICKFORD
An Instantaneous Detonating Safety Fuse
For SAFETY and EFFICIENCY

$9,000 worth of dynamite exploded in one blast at quarry of Dixie Portland Cement Co. The well-placed dynamite loosened enough limestone to keep the crushers and kilns busy for eight months or more.

Expert handlers of high explosives tamped fifty-four 6-inch holes with twenty-six tons of dynamite. The holes vary in depth from 92 to 105 feet all through solid rock. All of the charges of nearly half a ton each were fired simultaneously by means of Cordeau-Bickford detonating fuse.

THE ENSIGN BICKFORD CO., Simsbury, Conn.

Original Manufacturers of Safety Fuse **Established 1836**

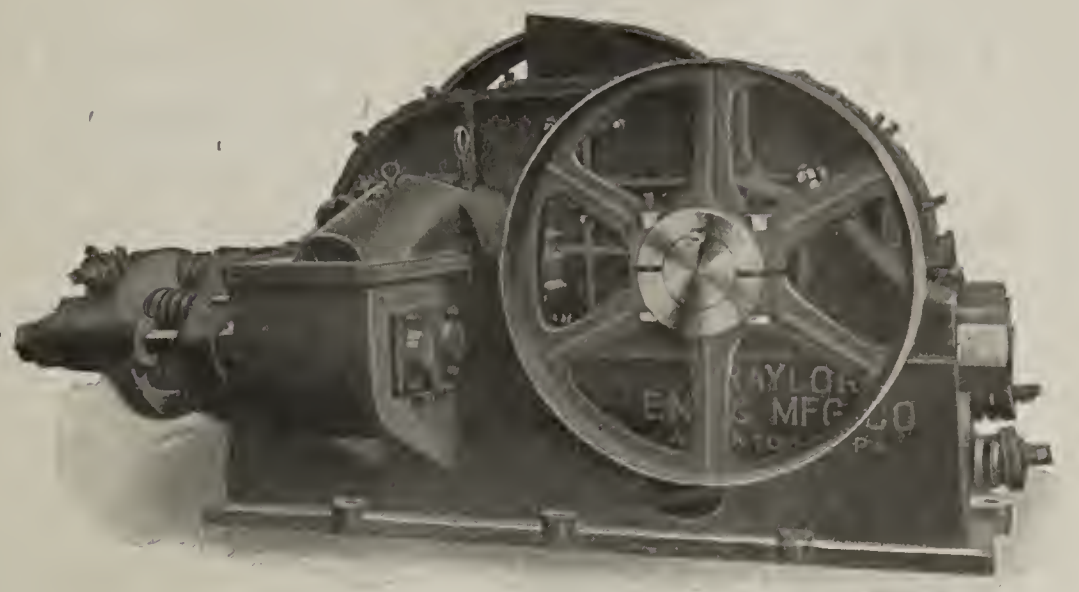
SAND
PUMPS
OF ALL TYPES

The Kingsford Sand and Dredging Pumps are built in all sizes for Engine, motor or belt drive and can be furnished with or without linings.

Our single stage Centrifugal and Multi-stage Turbine Pumps are guaranteed the most efficient made.

KINGSFORD FOUNDRY & MACHINE WORKS
OSWEGO, N. Y.

Have You Investigated



TRAYLOR
Crushing Rolls
For Your Medium Fine Crushing?

They have the "FLEETING ROLL" which eliminates the personal equation in keeping your rolls straight and true and free from ruinous corrugations. The "FLEETING ROLL" is always on the go, it never forgets. It does automatically, Mr. Superintendent, what you have fired many a man for not doing, *i. e.*, shifting the position of the fixed roll a couple of times each hour, and it's just the simplest device you ever saw.

Six Parts That Run in Oil. That's All

Send for Bulletin R-1 and "Successful Roll Operation"

TRAYLOR ENGINEERING & MANUFACTURING CO.

Main Office and Works: Allentown, Pa.

New York Office: 40 Church Street **Western Office: Salt Lake City, Utah**

Power & Mining Machinery Co.

Kiln Supporting Frame

Our Standard Design

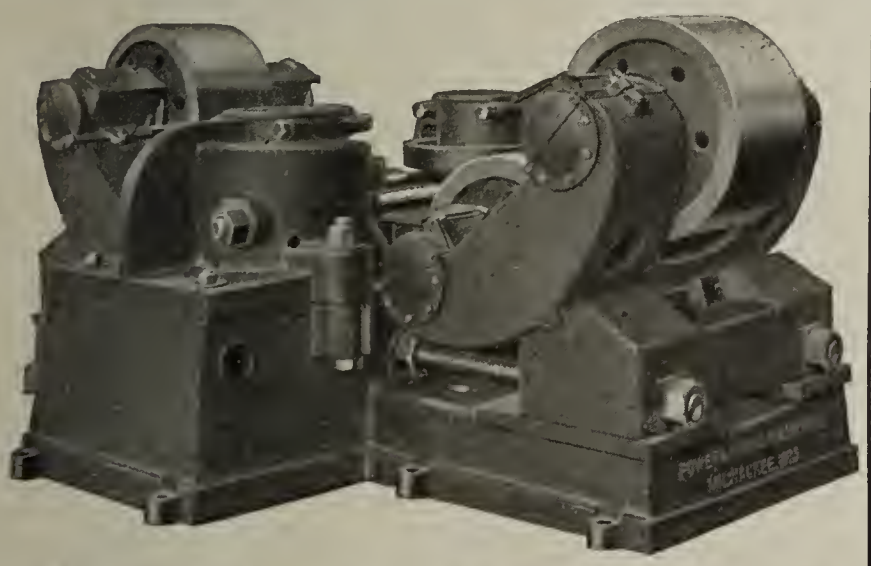
As built by us for the past eight years.

Twenty-five kilns ranging from 8′ x 125′ to 10′ X 240′ furnished to ONE CEMENT COMPANY, besides a large number of smaller installations.

This, as well as the universal approval of our design, is proof THAT IT IS THE BEST.

We also build Dryers, Coolers, Gyratory and Jaw Crushers, Pan Conveyors, Screens. etc.

Send for Catalogue No. 7-108.



WORTHINGTON PUMP AND MACHINERY CORPORATION

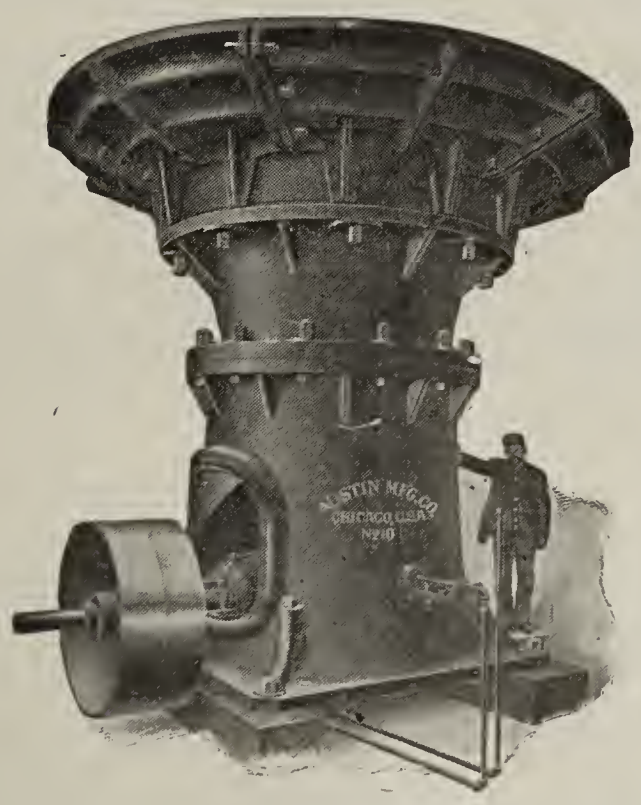
New York, 115 Broadway

Power & Mining Machinery Works - Cudahy, Wis.

District Offices—Chicago, El Paso, San Francisco
W. E. Austin Machinery Co., Atlanta, Ga.

M 311.2

Austin Gyratory Crushers



The World's leading Ore and Rock Crusher. Its many superior qualities and mechanical advantages have won the highest reputation amongst Mining Engineers and Quarrymen.

Made in NINE sizes with capacities from 50 to 5000 tons per day Smaller sizes can be mounted as Portable Plants. Thousands in use

Plans and specifications furnished for any size of Plant.

Austin Manufacturing Company

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THE FULLER ENGINEERING COMPANY

Designing, Constructing and Operating Engineers

Cement and Hydrated Lime Plants a Specialty

Reports, Examinations and Analyses of Raw Materials for Cement Consultations Solicited

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Remodeling and Operation of Portland Cement Plants a Specialty

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INDIANAPOLIS

Designing and Consulting Engineer

Reinforced Concrete Bridges Exclusively

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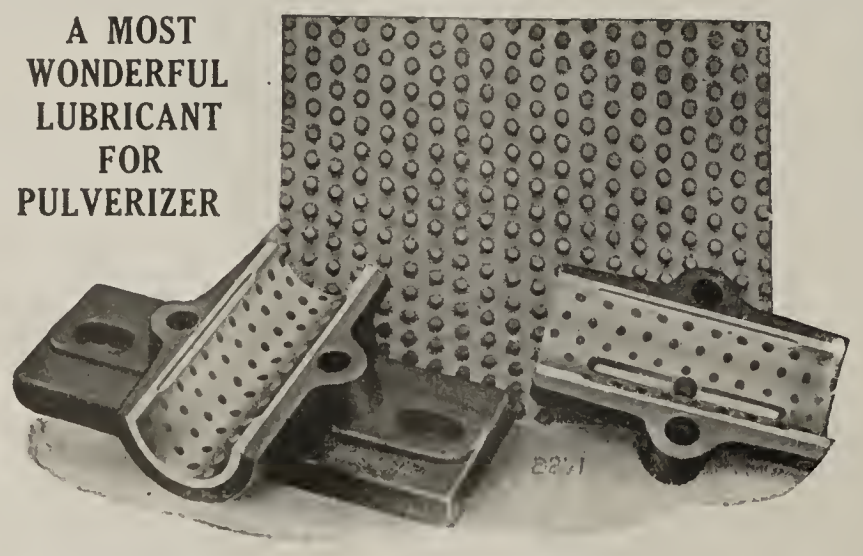
WATER SOFTENING OR FILTRATION
FOR BOILER FEED AND ALL INDUSTRIAL USES
WM. B. SCAIFE & SONS CO. PITTSBURGH, PA.

A MOST WONDERFUL LUBRICANT FOR PULVERIZER



Randall Graphite Lubricator

Is a Positive Remedy for all Bearing Troubles

It is the one and only means by which Heating of the bearings can be entirely overcome.

It is rapidly being adopted by cement manufacturers and managers of industrial plants in all lines of business, with most excellent results.

Write for information and trial order plan

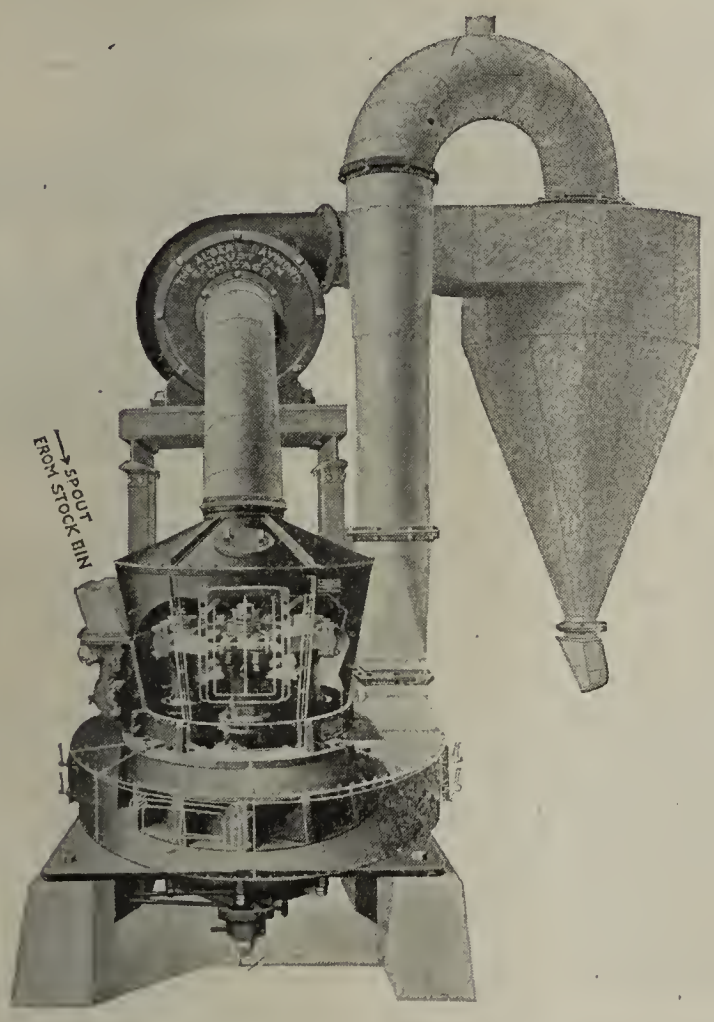
Randall Graphite Sheet Lubricator Co.

816 W. Lake St., Chicago

Iowa's First Cement Mill

The Northwestern States Portland Cement plant, located at Mason City, Iowa, is the seventh which the Cowham System has erected. It is one of the most modern and successful cement mills in America, having an annual capacity of about 1,750,000 barrels and is equipped with

THE RAYMOND PULVERIZING AIR-SEPARATING SYSTEM



The Northwestern plant represents an actual cash investment of $2,700,000.

All the most modern features of cement manufacture have been adopted, and every effort made, with gratifying success, to secure a dustless plant. There are 12 kilns 110 ft. long and a large amount of coal is used in these rotaries. The coal, after being dried and powdered in Raymond Mills, has a fineness of 97 per cent passing the 100 mesh sieve.

The most efficient method for grinding coal and raw material in the cement industry is the Raymond Roller Mill with air separator. No known mill or method grinds so fine nor with so little expense. Its record is unsurpassed.

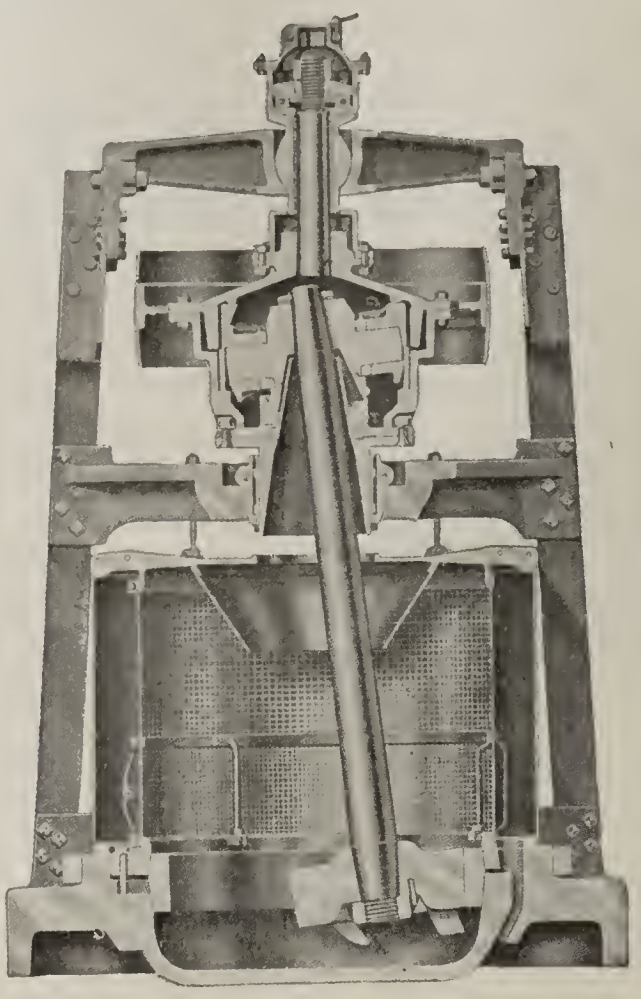
The Raymond System is used in every process of manufacture where finely ground material is required.

Practically all the new Hydrated Lime plants are equipped with the Raymond System.

Write for Catalog

Raymond Bros. Impact Pulverizer Company

1310 North Branch Street CHICAGO, ILLINOIS



The New Cement Specifications

WERE ANTICIPATED BY US
AND OUR LATEST TYPE

Giant Griffin Mill

Produces material 82-83% through 200 Mesh at the minimum cost. This type of pulverizer has always beaten the specification two to five points, and will continue to do so with the new specifications in effect—

CAPACITY

CLINKER —13-15 barrels per hour
FINENESS—82-83% through 200 mesh
H. P. —80-85

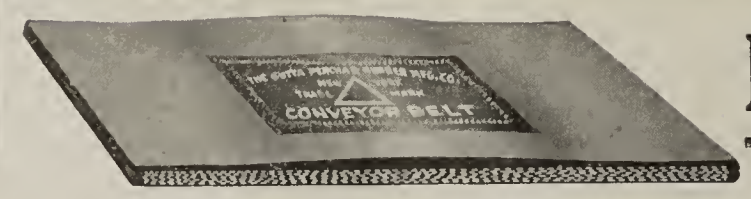
Send for complete data showing new improvements

BRADLEY PULVERIZER CO.

BOSTON

Works: Allentown, Pa.

Note the Wear-Resisting Features in this Conveyor Belt



Made for Hard Rough Work

Triangle Conveyor Belts are made to meet particular cement mill, gravel and rock crushing demands. They have features found in no other belt — features that pay in work and economy.

The cover of Triangle Conveyor Belting is made to resist abrasion, wear and tear, and weather.

The cover has the stretch and life to absorb strains — thus obviating any separation of cover and first ply.

The duck is specially woven to insure greatest pull longitudinally.

Triangle
Conveyor Belting

The high quality of friction insures smallest percentage of deterioration.

Its cushion edge of strong resilient rubber prevents fraying, rot and mildew.

Write today for books on Belting, Hose, Packing and Valves.

Gutta Percha & Rubber Mfg. Co.

301 W. Randolph Street
CHICAGO

Zagelmeyer Cast Stone Blocks Make the Best Construction for Stucco Work

HERE is a new field with big possibilities opened up to the block manufacturer using the Zagelmeyer System. Because of the fact that cement block construction for Stucco work necessitates the use of absolutely water-proof blocks, it is not practical nor satisfactory to use any but blocks made by our system for this purpose.

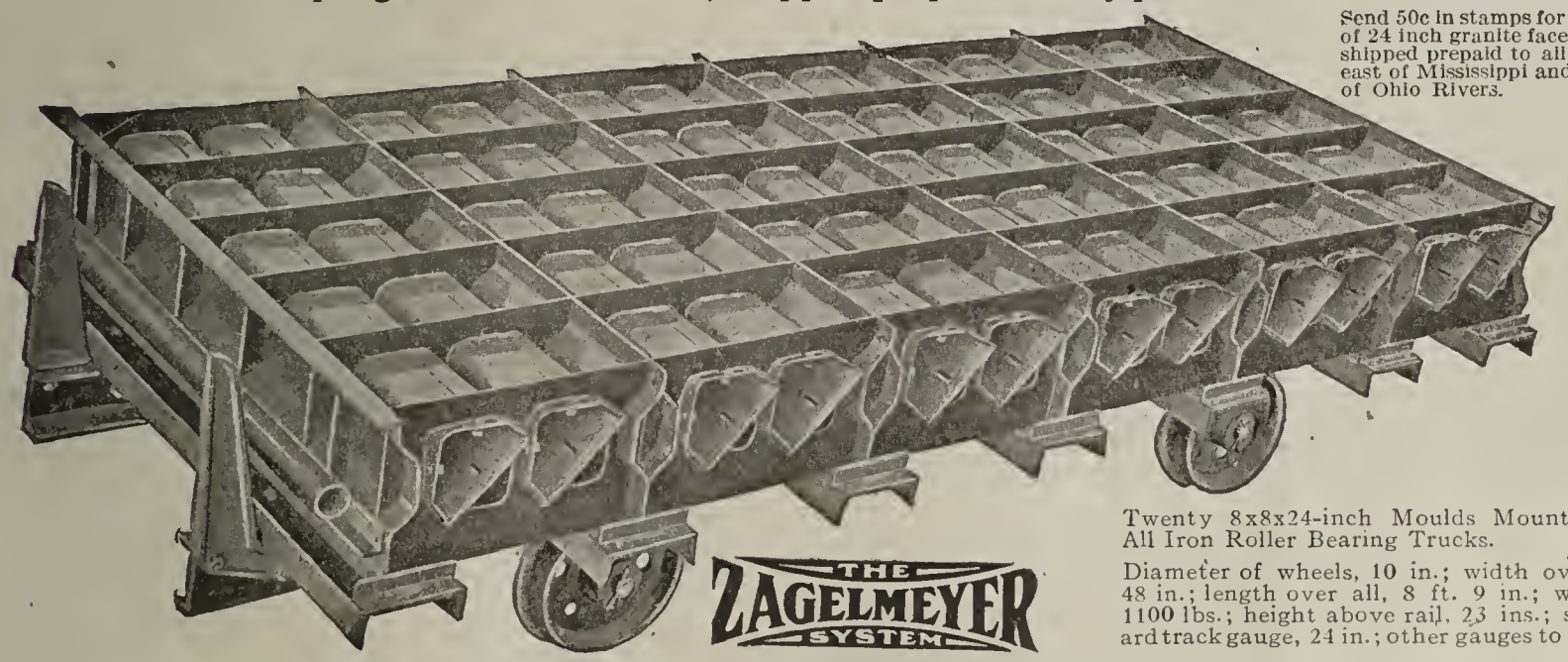
The demand for Stucco buildings is constantly increasing and a large volume of extra business has been secured in this line by block manufacturers using the Zagelmeyer process.

With a surface unexcelled for plastering, Zagelmeyer blocks offer a new and better construction for Stucco work than any other method heretofore in vogue. The hollow air chambers prevent cold from penetrating to the interior and being moisture-proof and of more durable nature than wood, tile or metal construction, these blocks make a stronger and better building.

The ratio of expansion and contraction of cast cement blocks is the same as cement Stucco, and for this reason Stucco applied to Zagelmeyer Cast Blocks never cracks or peels off.

Send for free sample granite faced block, shipped prepaid to any point west of the Mississippi.

Send 50c in stamps for sample of 24 inch granite faced block shipped prepaid to all points east of Mississippi and north of Ohio Rivers.



THE ZAGELMEYER SYSTEM

Twenty 8x8x24-inch Moulds Mounted on All Iron Roller Bearing Trucks.

Diameter of wheels, 10 in.; width over all, 48 in.; length over all, 8 ft. 9 in.; weight, 1100 lbs.; height above rail, 23 ins.; standard track gauge, 24 in.; other gauges to order.

We build complete plants with capacities from 500 blocks per day up, and turn them over to the purchaser in complete working order, or we sell the cars and molds, and the purchaser puts up his own building, etc. Our system being fully protected by patents, we are enabled to sell the exclusive right in a territory, thus giving the purchaser an absolute monoply of the business in his locality.

Blocks can be made by this system cheaper than by any other, and the product is so superior to all others now on the market that they sell for 25 per cent above the price of others. This makes it an exceptionally attractive business proposition.

Zagelmeyer Cast Stone Block Machinery Company

25 Crump Avenue BAY CITY, MICHIGAN

Send For Free Booklet of Interesting Cement Block Facts and Production Costs

Synstone *is* stone —just as artificial ice is ice.

FERGUSON SYNSTONE (SYNTHETIC STONE) SYSTEM

—a real business opportunity

The Synstone system represents a new method of manufacturing artificial stone, producing a half wall, stronger than brick, wood lath or plaster board forming the inside, using only *half the material; half the labor and half the cost of any other concrete wall that has ever been devised.* It costs less than 6c per square foot of wall to manufacture. It is a method pronounced by engineers to be scientific in every respect. Using a very wet mixture of coarse, aggregates, and the blocks are immediately removed from the machine.

It represents not only a method of manufacturing artificial stone scientifically, but a method of building these stones into a wall that in most localities will cost no more than frame construction. Synstone walls are hollow, dry and impervious to heat and cold. Synstone walls made and laid cost under 13c per square foot of wall.

A Synstone wall costs much less than "cement block" walls, less than brick, tile or natural stone —it absorbs no more moisture than natural stone —it will not crack—it will not discolor—it is everlasting.

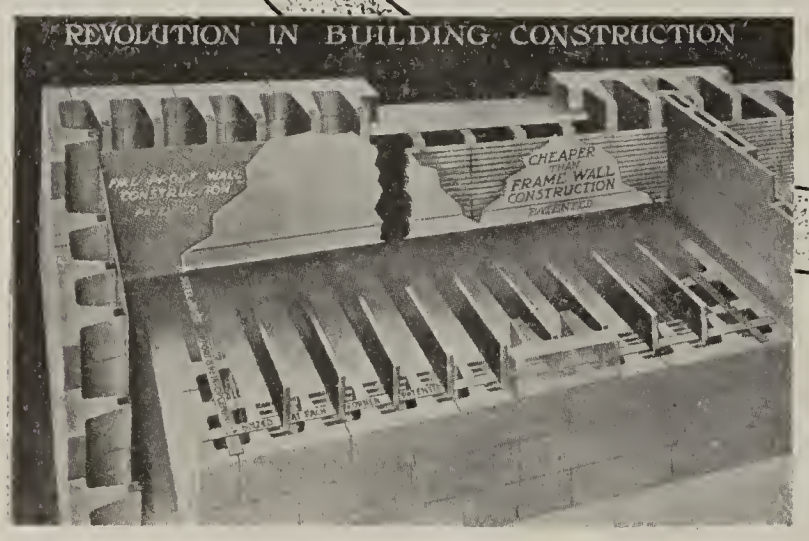
An Opportunity for Real Men

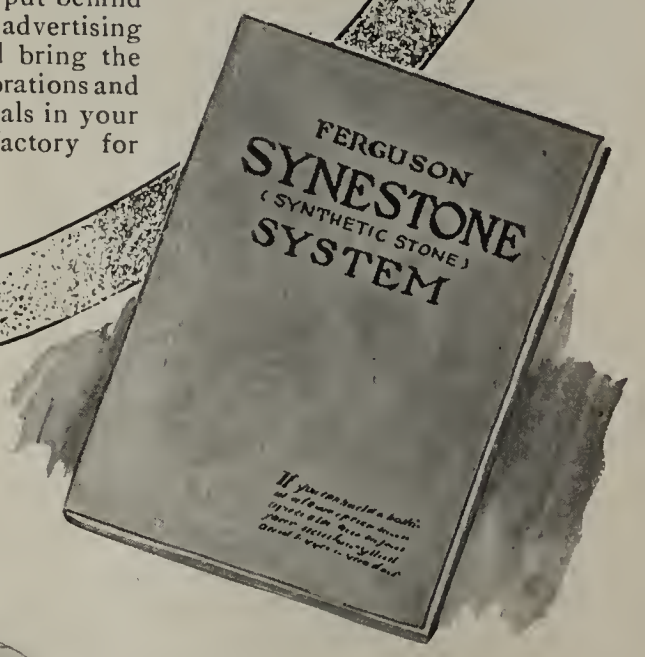
The equipment upon which Synstone is made is very simple; it is easily operated; it represents a very small investment.

We want one live concrete man in every locality to establish a Synstone factory.

We furnish complete machinery that may be operated by one, two or three men, common labor.

We are going to put behind Synstone a national advertising campaign that will bring the architects, the corporations and the private individuals in your locality to your factory for Synstone.





SYNSTONE WALL CONSTRUCTION

Note the one-piece wall construction at the left, expanded metal lath being used on the inside. A little farther to the right wood lath are shown. Still farther to the right is shown a 3½" partition built of Synstone. In the foreground note the steel plates supporting wood joists—producing a wall practically indestructible.

Molding the Block

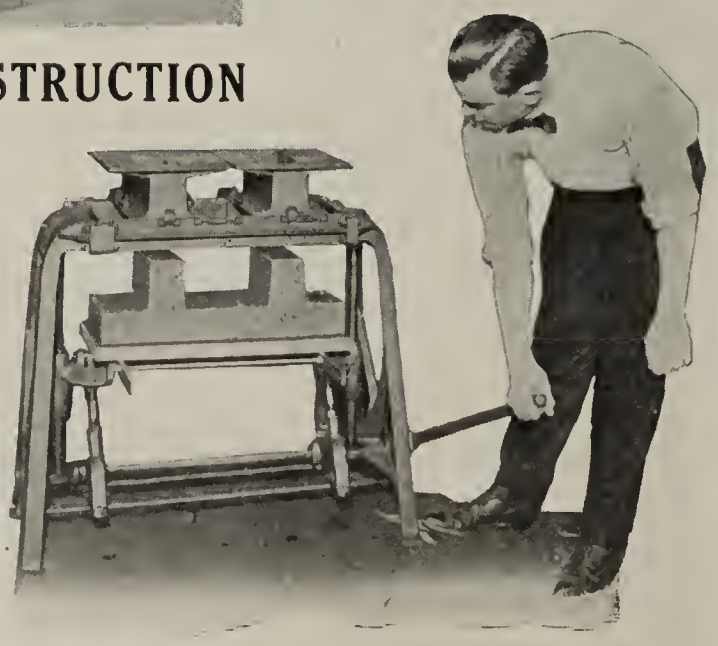
Remember—*wet* mixture is used. The finished Synstone on the pallet releases instantly and cleanly, without any saging.

A ¼" of any face matter you wish to use is placed in the bottom of mold and the wet, coarse concrete on the top, producing blocks with granite, marble or sand stone facing that have the life, sparkle and durability of real stone.

Address

The Ferguson Synstone Co.

846 Century Bldg. Denver, Col.

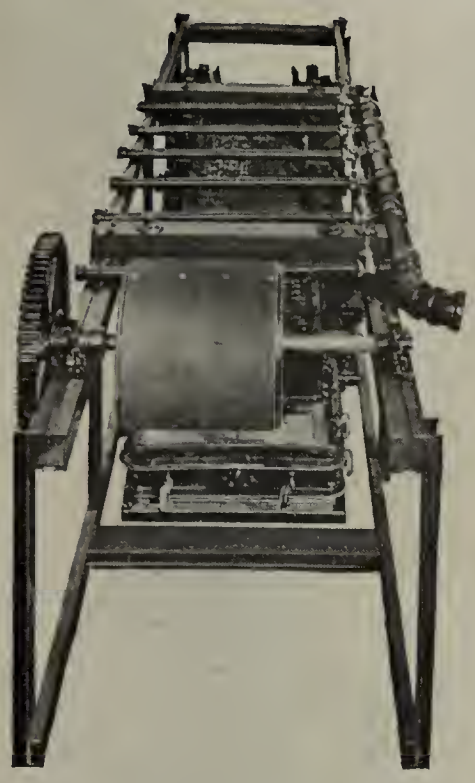


Send for the SYNSTONE Book

We have published a handsome book on the manufacture, sale and use of Synstone — it is full of illustrations of work done with this system of wall construction; it contains complete cost data, showing you how much it costs to make Synstone in comparison with "cement blocks," for instance, it contains complete specifications and full details. Write for this book today before some one else in your town secures the exclusive rights for this system.

The Gravel Screen of No Regrets

(Patented)



This E. & S. Twin Shaker Screen with Washer Attachment and conveyors recently replaced a $30,000.00 Screening and Washing Plant of a different type, and is today turning out 60 yards per hour of perfect graded and clean sand and gravel of five different sizes at an operating expense of less than One Cent per yard for both the screen and washer. Any size screens down to 30 mesh can be used, doing away with a settling tank if desired. At times as much as 50% clay is washed from the material.

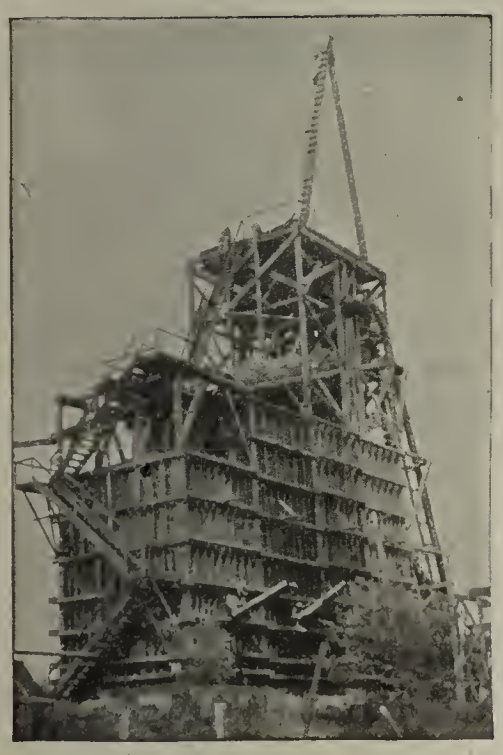
Minimum operating cost and up-keep with maximum capacity, perfect grades and clean material means Larger Profits.

We design and install complete plants.

Send for catalog and information on the E. & S. Twin Shaker Screens and Conveying Systems.

THE EXCAVATING & SCREENING MCHY. CO.
748 Security Building **Minneapolis, Minn.**

IF YOU WANT EFFICIENCY—
SPECIFY
DULL GRAVEL WASHING EQUIPMENT



The most successful gravel producers are using Dull machinery, and there are good reasons why.

During our fifteen years' experience in this particular field, we have perfected and patented labor saving devices which are daily proving their efficiency on numerous plants throughout the country. Efficiency fosters economy and greater profits, hence the popularity of Dull machinery.

We have designed and equipped dozens of plants to meet many difficult problems—conditions which are peculiar to each individual plant. You can have the benefit of this experience as our advice is free for the asking.

Drop us a line outlining your proposition or write for a copy of our booklet—"Plants for Washing Sand and Gravel."

THE RAYMOND W. DULL COMPANY
1916 Conway Building **Chicago, Ill.**

Residence of E. E. Olp, Evanston, Illinois
Built of granite faced Hydro-Stone
H. H. Richards, Architect

Hydro-StonE
PRESSED CONCRETE

The Superior Building Unit

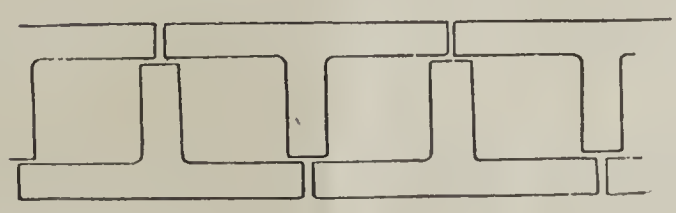
HYDRO-STONE opens up a new field for concrete product manufacturers. It gives them a product which competes with the best brick and stone in every class of building, and which can be manufactured at a cost that insures profit.

HYDRO-STONE machinery and wall construction are patented. Manufacturers of Hydro-Stone have exclusive rights in their respective territories. Competition is eliminated; profits assured.

HYDRO-STONE service, maintained by the Service Bureau of the Hydro-Stone Company, is at the command of Hydro-Stone manufacturers, and makes success certain through its constant co-operation.

Write for books on Hydro-Stone and for particulars of our proposition.

Hydro-Stone Company
259 Insurance Exchange Bldg.
Chicago, Illinois



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STRETCHING

EVERY ONE AN IMPORTANT STEP IN THE MAKING OF

TRADE SAWYER MARK Registered

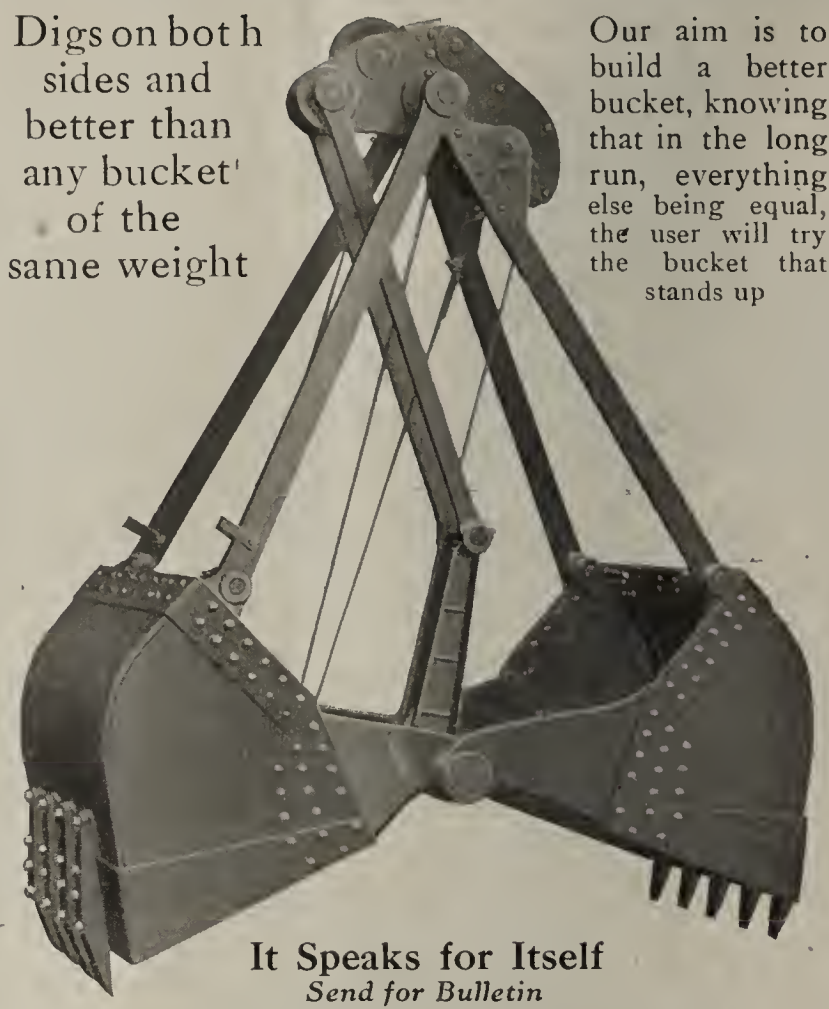
STITCHED CANVAS BELTING

SAWYER BELTING COMPANY
CLEVELAND

Bulldog Construction Throughout

Digs on both sides and better than any bucket of the same weight

Our aim is to build a better bucket, knowing that in the long run, everything else being equal, the user will try the bucket that stands up



It Speaks for Itself
Send for Bulletin

THE RUDDOCK BUCKET CO.
1501-1513 University Road, Cleveland, Ohio

The Rugged Ruggles

AERIAL CARRIER

Suspended over Slate Quarry

SELF DUMP BRAK LOCK ING

Built in Two Sizes:—1 to 5 tons capacity, 5 to 10 tons capacity.

The **Rugged Ruggles** is made for special use on cement and gravel construction work. For all kinds of quarries where the waste is taken from the pit and dumped at the surface. It will take any load up to **ten** tons, from any depth to the cable, where it is automatically released and sent either up or down the cable and dumped in mid-air or lowered. One man can operate three **Rugged Ruggles** on as many cables with a three-drum engine:

No brake to wear the cable—Can run on a flat cable.

Simple in construction; made entirely of steel; all the sheaves steel bushed or brass, and is backed by years of extensive use.

Manufactured by

Ruggles Machine Co., POULTNEY VERMONT Dept. C

Crushed White Stone and Marbledust

Adds Little To Cost—Increases Your Profits

Livens up Cement Work, Improves Appearance of concrete blocks, bricks and all concrete products; adds to looks of Stucco and is unsurpassed for brilliant Floor Finishes; Unexcelled for white plastering and exterior plastering.

We are prepared to furnish Prompt Shipment and Perfectly Crushed Materials at a short notice.

Send for samples of our material and let us quote you prices

CONLIN & CO. **Tuckahoe, N. Y.**

Concrete Plants, Contractors, Etc.

Secure our confidential processes, methods and formulas and make concrete marble granites, sanitary flooring, etc., and make money.

Write for details

ART STONE CO.

Box 330 **Waynesboro, Pa.**

Porch Mold Outfit $39.00

This outfit will make concrete porch as shown, also blocks for chimneys, piers, posts, ornamental fences, etc. Attractive designs, superior construction.

Concrete Rustic Flower Box Mold, $10

Attractive design. Made in several sizes. End and side plates are interchangeable for the different sizes. Fully described in Ornamental Mold Catalog.

Concrete Sewer Pipe Pays Well—*With Dunn Molds*

Here's a business that's booming—a business requiring an insignificant investment, and paying several hundred per cent profit on manufacturing costs.

Investigate what a hundred feet of sewer pipe sells for in your town; then figure that your costs of manufacture would not exceed $7.75. The profit will surprise you.

Dunn Molds use the **wet,** or **poured,** process. This not only assures a denser, firmer product than the tamping process, but saves labor and time. The poured system is **positive** in good results; the tamping system is a matter of **guesswork.**

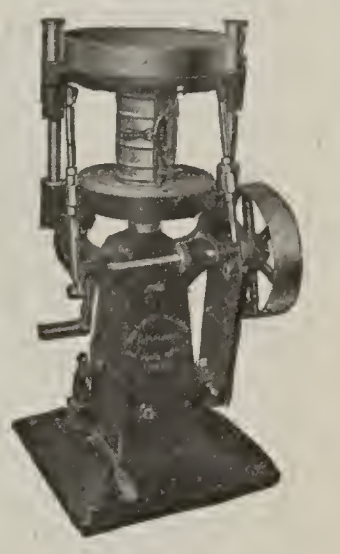
Dunn Pipe Molds

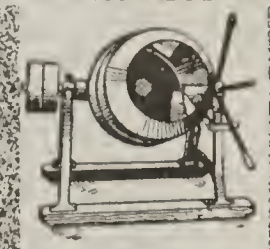
Dunn Sewer Pipe Molds are made in sizes for making pipe from 6 to 36 inches in diameter, with thickness of walls varying according to the size of pipe. Their operation is so simple that it is almost impossible to make other than a high quality product. All are sold on **15 days' trial.**

Write for our Pipe Mold catalog for prices on all sizes.

Dunn Tile Machine

"The machine that created the tile business." Small in price, big in capacity. Easiest to operate. Simplest in construction. Lowest in labor costs. Highest in efficiency. Makes the densest, strongest cement tile ever marketed. 1, 2 or 3 man operation. Rigidly guaranteed, and sold on **15 days' trial.**





Concrete Mixers on Skids, from $67.50

Lever discharge only on small sizes; other sizes power or hand-wheel discharge. Prices and specifications in Dunn Mixer Catalog.

W. E. Dunn Manufacturing Company

414 24th Street HOLLAND, MICH.

CEMENT TILE	CEMENT TILE	CEMENT TILE
It's Costs and Profits, and Possibilities as a Business	*How to Successfully Start and Operate a Tile Plant*	*How the Sale of Tile is Developed and Increased*
By W. E. DUNN, Pres., W. E. Dunn Mfg. CO.	By W. E. DUNN, Pres., W. E. Dunn Mfg. CO.	By W. E. DUNN, Pres., W. E. Dunn Mfg. CO.

Send for these Free Bulletins

Bulletin No. 1 gives complete information on the Costs, Profits and Possibilities of cement tile as a business.

—tells why farmers are buying more drain tile.
—why the cement tile business is bound to grow.
—why cement tile is preferred to a clay product.
—how the manufacture of cement tile has been simplified and lowered in cost.
—gives figures on kind and amount of material required for making tile.
—gives tables on manufacturing costs.
—gives conservative estimate on average selling prices and profits.
—tells what local conditions are favorable to starting a tile business.

Bulletin No. 2 tells how to successfully start and operate a cement tile plant.

—gives information on proper location of plant, and what kind of building is most desirable.
—tells how to secure maximum production at minimum cost.
—describes the relative costs and benefits of different curing systems.
—explains the most economical and profitable methods of operation.
—tells what proportions of material should be used, and how it should be mixed.

Bulletin No. 3 gives valuable information on how to sell cement tile.

—tells how profits can never be made greater by sacrificing quality.
—explains the value of using local newspaper advertising, and illustrates electrotyped advertisements.
—tells how cement tile can be marketed through building material dealers.
—explains how business can be secured by letter.
—shows how lantern slides can be used effectively
—and outlines the Dunn policy, which assures success.

How to Get Them

These three important bulletins, completely describing the cement drain tile business, should be read by every contractor, and by any man wishing to build a permanent business of his own. We will send them absolutely free upon receipt of accompanying coupon properly filled out.

W. E. Dunn Manufacturing Co.

414 24th Street HOLLAND, MICH.

Be Sure to Fill Out and Mail This Coupon

Date.....

W. E. Dunn Mfg. Co.,
414 24th St., Holland, Mich.

Gentlemen: Kindly send the three Cement Tile Bulletins as advertised. This implies no obligation on my part except to read them.

Name .....

Address .....

Business now engaged in.....capacity.....

DAMP-PROOFING

PERCOPROOF COMPOUND

Makes Foundations impervious to Moisture : : : :

APPLIED with a brush direct to foundation walls, concrete construction, masonry or stucco surfaces, Percoproof forms an unbroken, elastic facing that fills every pore and crack and prevents all seepage and moisture from penetrating.

WRITE for our Damp-Proofing Booklet.

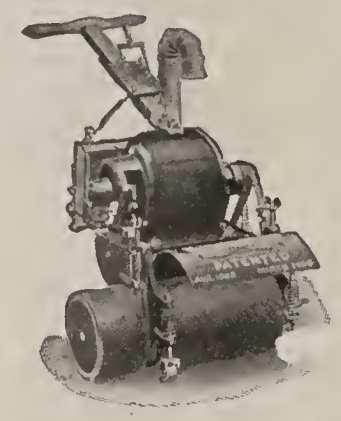
Unlike ordinary waterproofing materials, Percoproof contains no oil and requires no thinning. It comes ready for use and is equally satisfactory in all climates and at all seasons.

Eight Thousand Gallons of Percoproof were used for waterproofing the eighteen great buildings that constitute the Cincinnati General Hospital.

THE PHILIP CAREY CO. 132 Wayne Ave., Lockland, Cincinnati, O.

TEST AND TRY BEFORE YOU BUY—THE

Schlueter Rapid Floor Surfacer

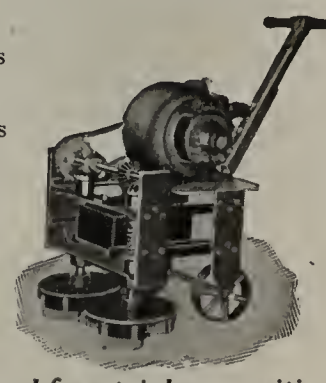


The Schlueter BALL BEARING electric floor surfacing machines for mosaic, marble, composition and wood floors are the most simple constructed machines on the market. Direct chain drive AUTOMATIC DUST COLLECTORS.

No gears or clutches to wear.

Made in various styles.

OVER 5,000 IN USE ALL OVER THE WORLD



Send for prices and free trial proposition

M. L. SCHLUETER CO. 225 W. Illinois St., CHICAGO

THE "LITTLE GENERAL" LEADS THE "BIG DRIVE"

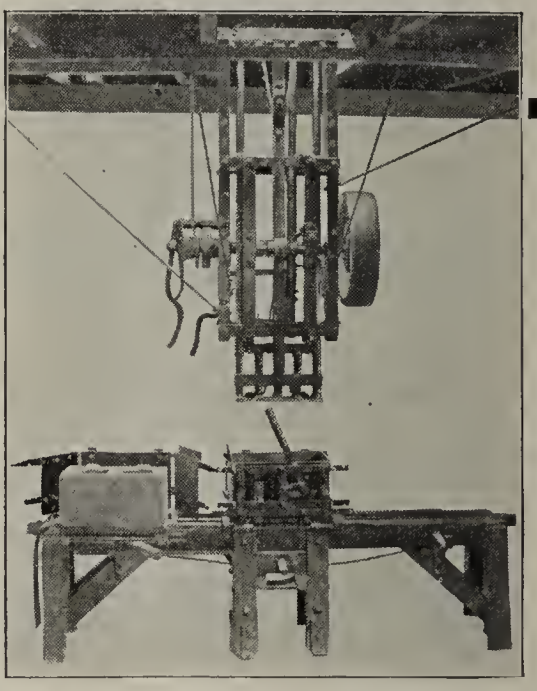
On construction work—where the "big drive" is to save time and lower labor costs—the Little General is a winner.

A Little General does several men's work, and does it quicker. Save 25c a thousand on elevating brick, compared with old-fashioned methods. Will handle all building material up to small girders. The

"Little General" Material Elevator

is big enough in capacity and small enough in cost to be a dividend-paying investment for every contractor. Rigidly constructed and will last a lifetime. Equipped with Novo engine. Readily portable. Write for special literature.

H. B. Sackett Screen and Chute Co.
1679 Elston Ave. CHICAGO
Branch Warehouse:
197 Medford St. Charlestown, Mass.



The last word in cement block making. A continuous block machine. Make a block and remove a block at the same time.

Tamper runs continuously, thus reducing the labor costs and increasing the output.

Hazelton Power Tamper and Cement Block Machine

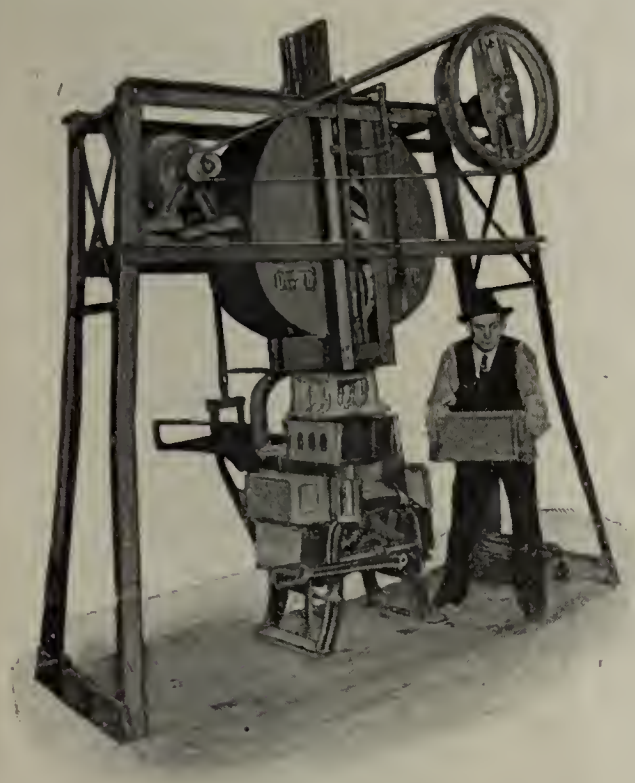
makes a better block than is possible by any other method. Uneven tamping, imperfect tops and cave-ins are wholly avoided. No posts or timbers in the way—the tamper hangs from ceiling. One horsepower ample to operate.

Economical, because power is supplied only as needed. Machine in successful operation for years.

Guaranteed absolutely against all breakage for one year. We want dealers everywhere. Write for our attractive proposition.

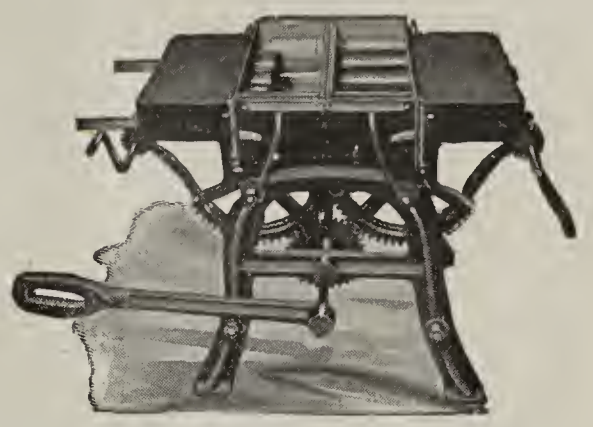
GREER MACHINERY COMPANY
292 Toledo Street, Delaware, Ohio

DOUBLE SPEED POWER TAMPER



Newest and Greatest Cement Machine Improvement—

The Monarch Double Speed Tamper is absolutely the most valuable piece of equipment that you can put in your plant. A complete tamping device in one unit to use with either the Block Machine or the Brick Machine. Enables you to tamp with power any cement products that either of these machines will make and make *better* Bricks and Blocks, make them faster and at less expense than they can be made with any other equipment. *The Double Speed Tamper* is especially made to operate over either machine with equal efficiency. It can be driven either by a 2 H. P. motor or gasoline engine and is equipped with a locking device that locks every other foot. When starting to tamp blocks the feet that work between the cores work alone, shifting a lever starts the feet that tamp on top of the cores.



This Tamper has an automatic device which removes surplus material from the machine and makes a perfect face and smooth back on every brick or block.

The Monarch Double Speed Block Machine will make 1,500 blocks in an 8-hour day—each block will stand 10,000 lbs. more crushing power than any two-core block, and weighs about 5 lbs. less, which means with 1,500 blocks per day you save 7,500 lbs. material, or 1,800 lbs. of cement at 45c per cwt. You save in cement alone $8.10 per day. Taking cement, other material and labor, your saving with the Monarch Double Speed Machinery will amount to nearly $20.00 per day.

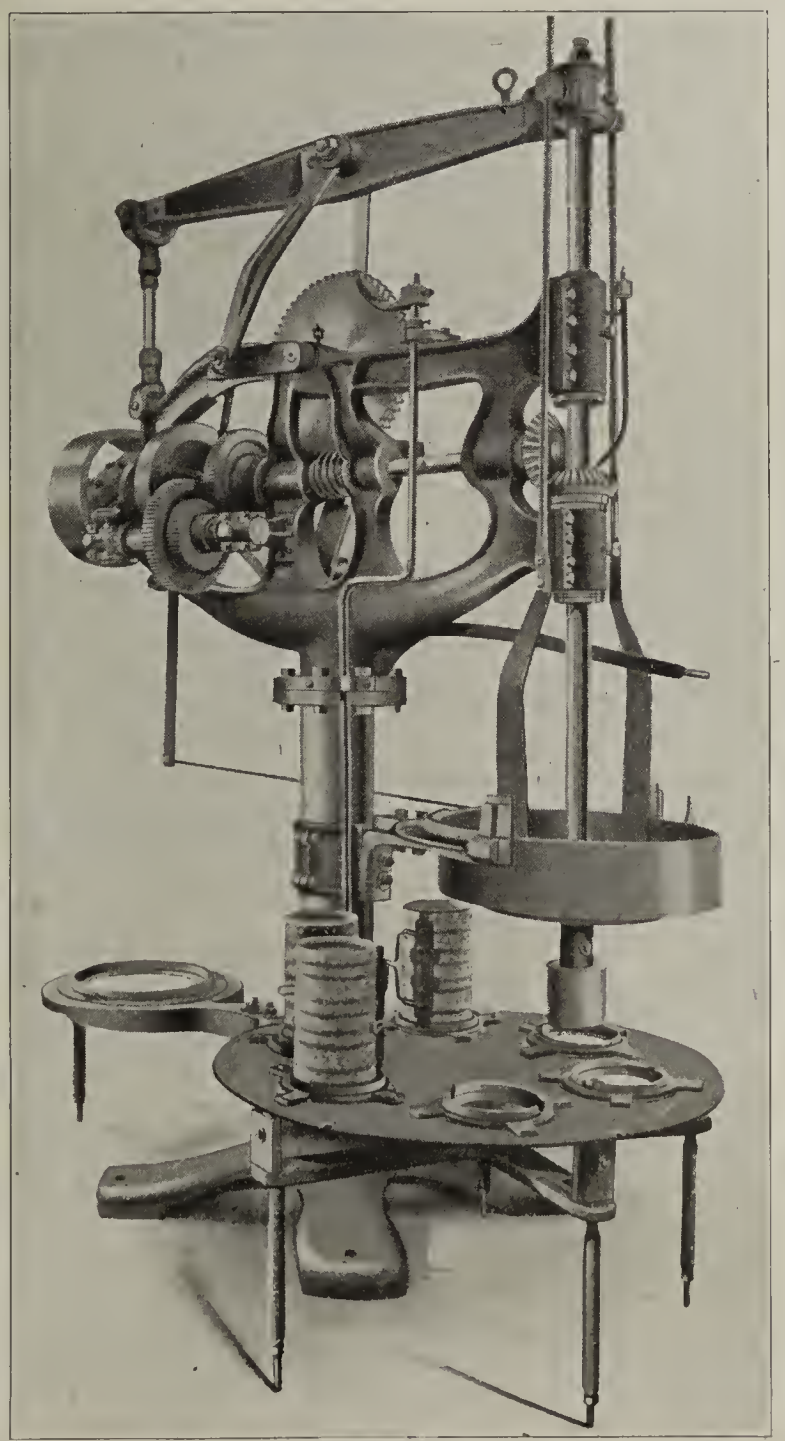
MONARCH

Cement Tile Machines

The most completely equipped, modern, efficient and satisfactory machine for the rapid and economical production of cement tile that money can buy. A proven *profit maker,* used and recommended by the most successful, practical tile men. *Different from other tile machines and better*—Constructed along progressive lines and embodying new and valuable features that insure perfect tile at minimum cost for labor and material.

The Monarch has *solid cast frame construction.* It is a heavy duty machine, strong and sturdy enough to stand any strain that can possibly be put on it in service. Eliminates vibration and the frame and bearings *cannot get out of alignment. Good for continuous hard service.*

MONARCH TRADE DOUBLE SPEED MARK MACHINERY



FEATURES

That Make Monarch Values

It is the modern, improved design, powerful, dependable construction and high grade material in the *Monarch Tile Machine* that make it the biggest value on the market. It's made right and has every quality you can ask for in a tile-making machine.

Bearing Caps are all extra large and are held in place by steel cap screws with lock washers.

Walking Beam is a solid casting, driven from both sides. Cannot twist and bind the packer shaft. Connected to the packer shaft by a fixed bearing—not a slot and pin.

Adjustments—Adjustments for different lengths of tile are made by shifting collars on the main column. Packer Shaft stroke is adjustable through crank arms on the worm gear.

Investigate the Monarch *fully*—compare it on its merits, with any other tile machine before you buy.

MONARCH MANUFACTURING CORPORATION

Boone, Iowa, U. S. A.

"OLD RELIABLE" "XX"—Our Motto is "QUALITY FIRST"

The Only Chain That Requires No Guarantee

Made only by THE HAYDEN CORBETT CHAIN CO., Columbus, Ohio

"OLD RELIABLE"
HIGH GRADE CHAIN
Some manufacturers make several grades of so-called Shovel Chain.
We make one grade.

Pebbles for Tube Mill Grinding

Specially Selected for Cement Manufacturers
PRICES QUOTED ON APPLICATION

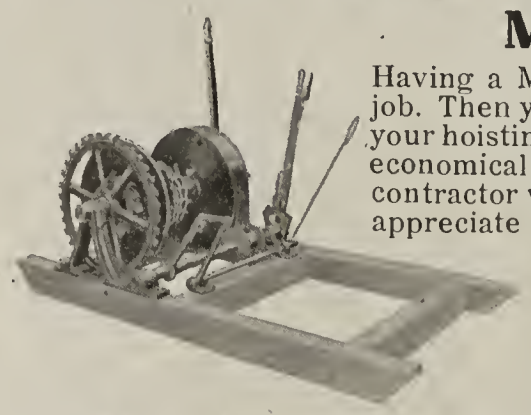
ENCINITAS PEBBLE COMPANY ENCINITAS, CAL.

TRY AND SEE WHY
TAYLOR
MESABA

is universally admitted to be the best
STEAM SHOVEL CHAIN on the market
Sizes carried in stock
⅞" 1" 1⅛" 1¼" 1⅜" 1½" 1⅝"

S. G. TAYLOR CHAIN CO.
140 So. Dearborn St. Chicago, Ill.

PREPAREDNESS
MEANS



Having a MORGAN Hoist on the job. Then you are ready to handle your hoisting problem in the most economical way. Every up-to-date contractor who has an engine, will appreciate the many good features of the MORGAN

Capacity 2,500 pounds. Chain and sprocket driven. We manufacture a complete line of Friction Clutches and Hoists.

The Brown Clutch Company
Sandusky - - - Ohio

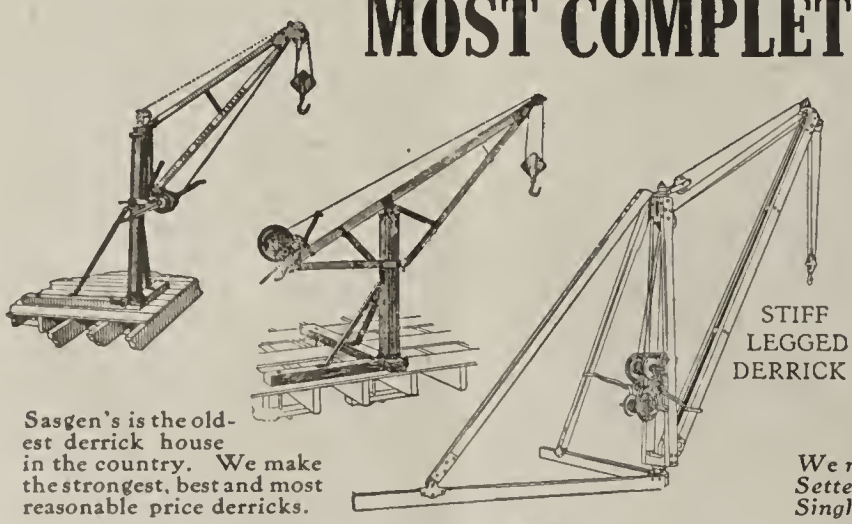
BURN-ALL 100% INTEREST

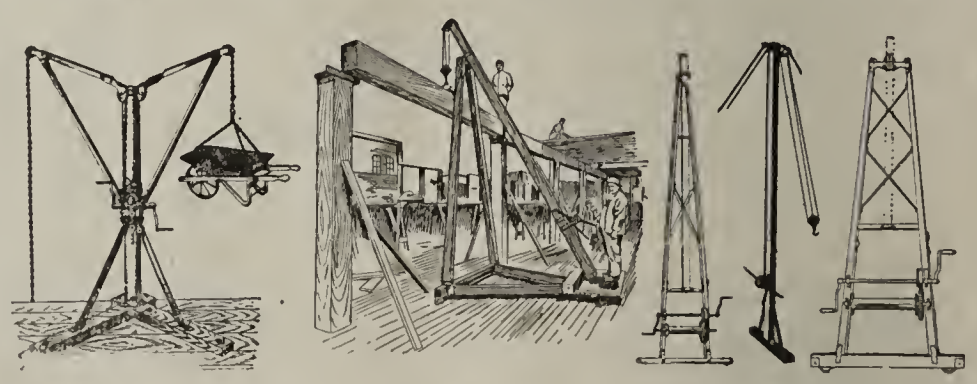
on the money you Spend for Coal

Install Burnall Fuel Savers on your Heating Plant and water heater and get better heat with 25% less coal. Burnall captures the gases now going up the chimney and lost. Made to fit all kinds of heating boilers and water heaters—old or new. Original investment saved the first year. Buy now and collect your dividends.

BURNALL CORPORATION
Harry G. Tucker, Pres.
North American Building CHICAGO

MOST COMPLETE LINE OF BUILDERS' DERRICKS





Sasgen's is the oldest derrick house in the country. We make the strongest, best and most reasonable price derricks.

We manufacture Steel and Wood Circle Swing Builders' Derricks, hand and power, Pole Setter, "A" Frame, Double Boom Wheelbarrows, Stiff Legged and Guy Line Derricks Single and Double Drum Geared Winches, Blocks, etc.

SASGEN DERRICK COMPANY, Grand and Albany Aves., CHICAGO

WRITE FOR CATALOG No. 15

Get into the Burial Vault Business

In every town and county in this country there is a big, glowing opportunity for a live man with some capital, some business ability and a lot of energy to found a permanent, profitable business manufacturing the Chicago (Janisch Method) concrete burial vault—for which there is a national demand. No Royalties; Never a Failure. Costs less to make than others, therefore more profit.

It doesn't cost much to start in this business, and it's steady the year around. Write today for our catalog.

Chicago Cement Burial Vault and Casket Company

5301 RAVENSWOOD AVE. CHICAGO

Winter

Doesn't Stop the Sealing Vault Business

There is a constant demand the year round A demand that you can supply with just one set of our Steel Molds. Think how nice it would be to have a neat little income during the winter months and all the year round.

The AUTOMATIC SEALING VAULT

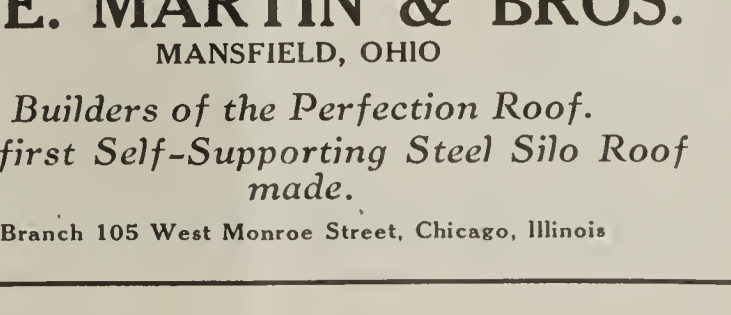
pay big profits from fifteen to 24 dollars on each one. You can develop this as a side line or devote all your time to it. Make the dollars come in this winter by making the AUTOMATIC SEALING VAULT.

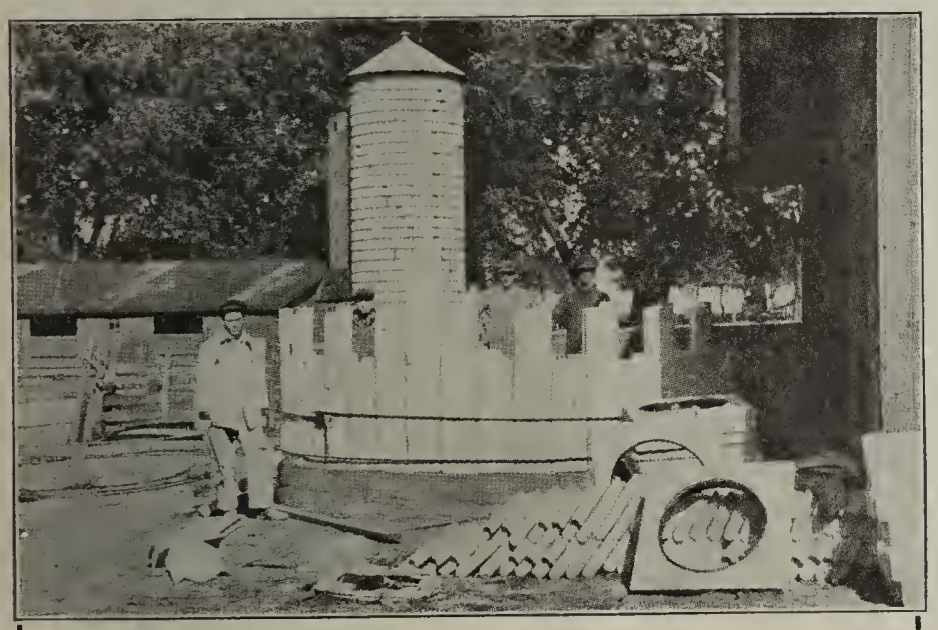
The First Step is to send for information. We'll furnish full details and particulars. Write Today.

The Automatic Sealing Vault Co.

216 East River Street - - - Peru, Ind.

The Finished Vault





HERE'S a chance to get into the silo business and to keep the profits where they belong — in your own pocket.

You can start into this business without a great expense if you select the right system. *We* can start you on the "right system."

Buy a set of Caldwell molds and make Silo Staves as you make building blocks. No royalty to pay. No territory to buy. We sell the outfit without strings attached to it. This is a good proposition and it will mean money to you.

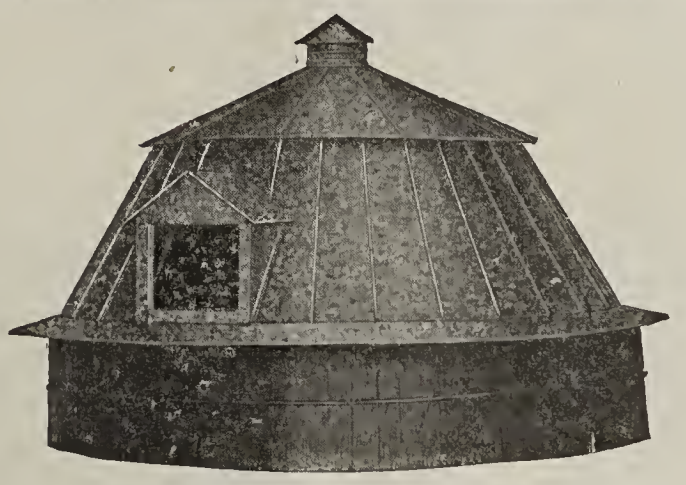
Caldwell Stave Silos are permanent because each unit is made of poured, reinforced concrete, each unit interlocks with the six adjoining staves and each unit is crossed by three steel bands, resulting in a storm-proof, water-proof, air-proof, acid-proof, fire-proof silo that you can sell.

The most businesslike silo proposition on the market will be sent free on request. Write today for an outline of our system.

Co-operative Concrete Construction Co.

OSKALOOSA, IOWA

Build Your Silos Complete



Our Air-tight Self-Supporting Steel Roof is designed especially for cement and masonry silos. Easy to erect and a perfect fit. A roof sold with your silo means a better satisfied customer.
Get our prices to silo manufacturers today.

C. E. MARTIN & BROS.

MANSFIELD, OHIO

Builders of the Perfection Roof.
The first Self-Supporting Steel Silo Roof made.

Branch 105 West Monroe Street, Chicago, Illinois

Did you ever feel the need of a lighter, cheaper, simpler Locomotive Crane? Mounted on Road Wheels?

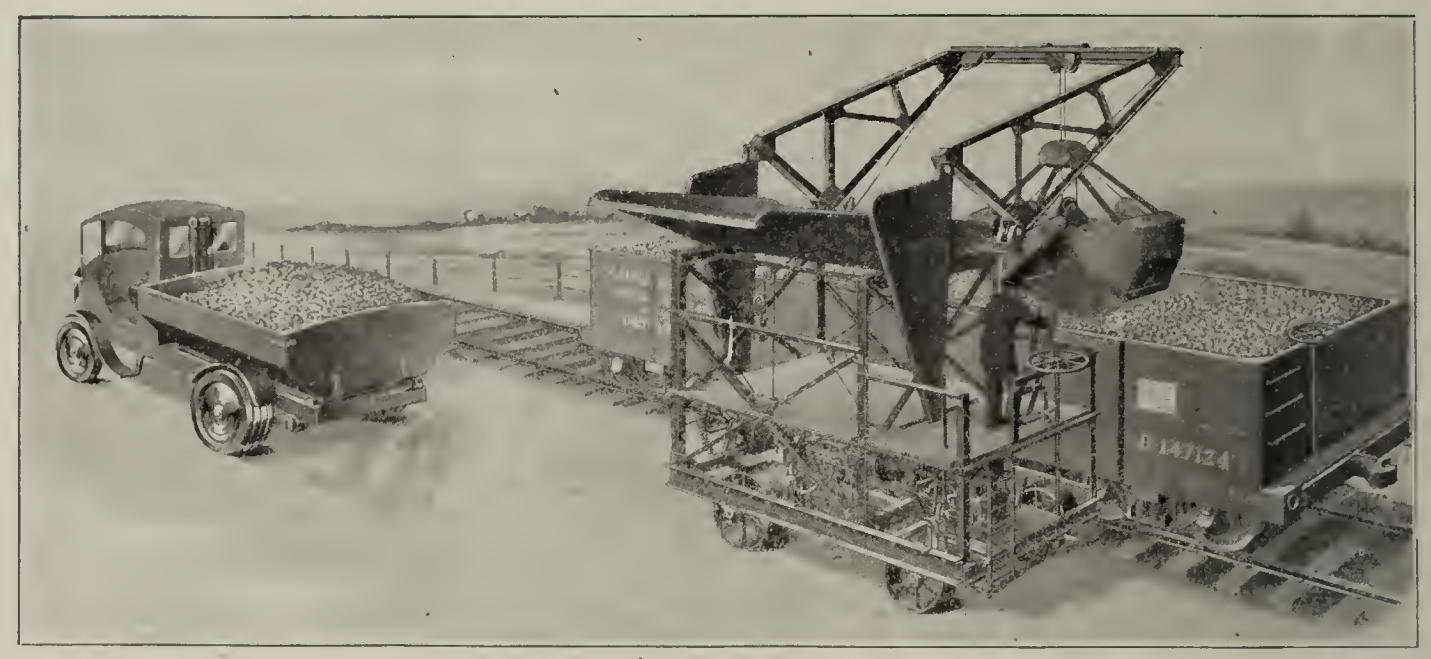
BYERS AUTO-CRANE

Fills that need. Let us tell you more about it.

Chicago Office: 1440 Monadnock Block
Cleveland Office: 601 Sincore Bldg.

JOHN F. BYERS MACHINE CO.
260 Sycamore St. RAVENNA, OHIO

REDUCE COST OF UNLOADING CARS



By using the **Quick Shovel,** made for the ordinary man to run.

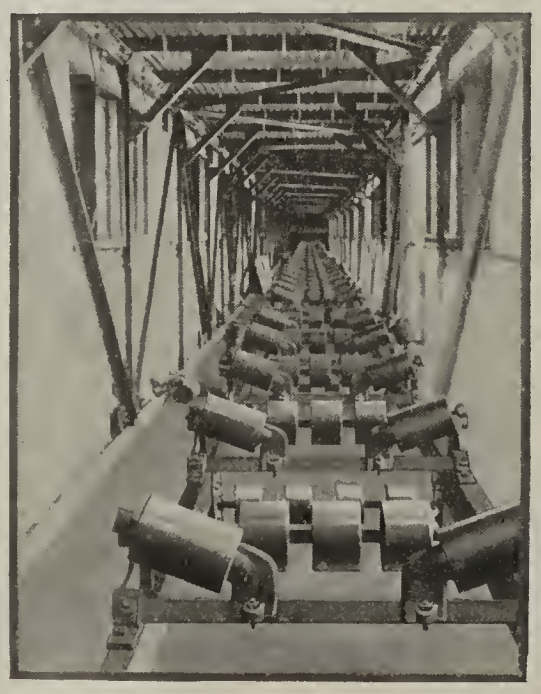
Self-Propelling—Gasoline or electric power. **No waiting** of trucks, large **Self-dumping Hopper. Clear View** of operator with everything at perfect **control from platform.** Will handle any bulk material from Gondola cars or Ground-storage.

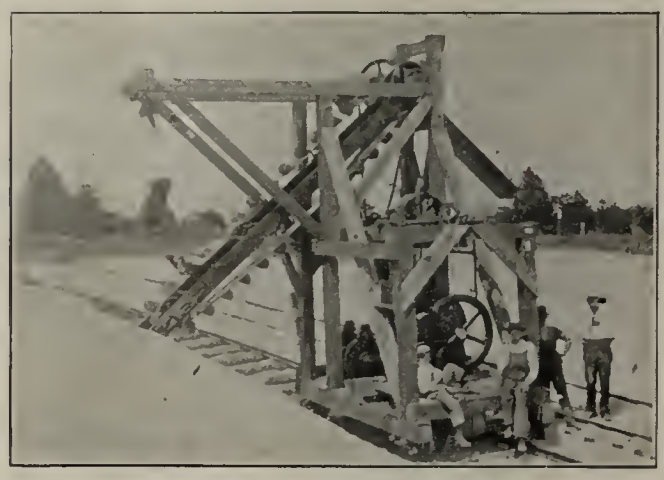
Three cars per day will pay for machine in one year.

Start today—service means money.

Prices furnished on application.

AMERICAN QUICK SHOVEL CO., Inc.
666 Peoples Gas Bldg. CHICAGO, ILL.





Sand Loading Machine Loading Direct from Bank Into Car

We make complete plants for handling crushed stone, gravel, sand, coal, ashes, clinkers, grain, and flour. Also conveyors and elevators for handling packages and merchandise.

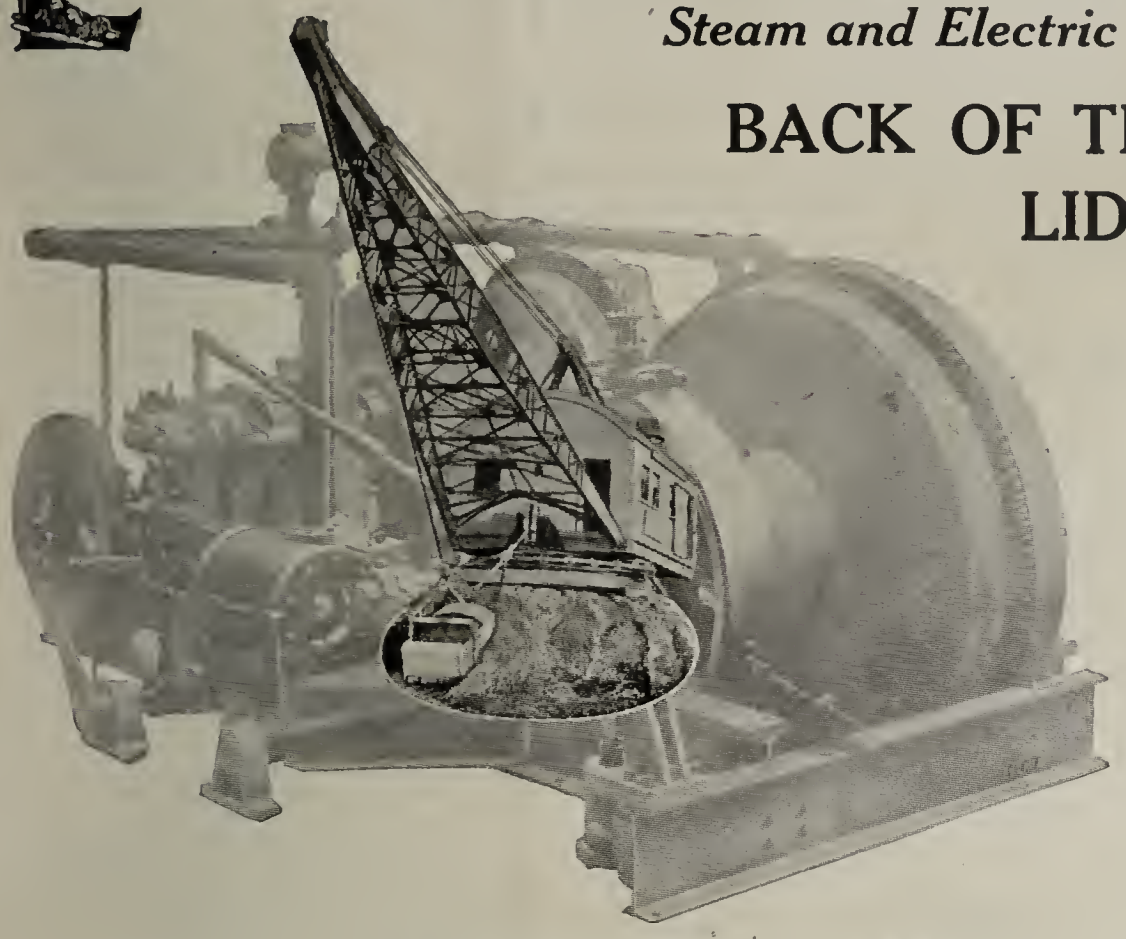
Samuel Olson & Co.

Engineers, Manufacturers and Contractors

2418-2422 Bloomingdale Avenue CHICAGO

LIDGERWOOD DRAG LINE EXCAVATORS

Steam and Electric



BACK OF THE BUCKET IS THE LIDGERWOOD ENGINE

insuring the most powerful digging combination.

There is strength in every detail of the excavator consistent with the power of the engine.

Built with booms from 50 to 100 feet, operating 1½ to 3½ cubic yard bucket.

Will operate grab bucket.

Write for Bulletins.

LIDGERWOOD MFG. COMPANY

96 Liberty St., NEW YORK **Fisher Building, CHICAGO**

STREICH Dump Wagons

1. Chicago Second Regiment Armory Job.
   W. J. Newman, Contractor.

2. Chicago Lake Front Improvement.
   The Ryan Co., Contractors.

¶ About 90% of the Dump Wagons purchased in the City of Chicago are Streich's. There is a reason. Our wagons run easily because the axles are properly set, and wear long because they are made of the right kind of stuff.

¶ This wagon will dump anything from cinders to the stickiest kind of clay. Weight of contents of load when dumped automatically forces the bottom doors up the sides of body, allowing bottom doors to clear pile. You never see a Streich wagon stalled and you never see a driver shovel in order to get free after a dump.

¶ We build One and Two Horse Wagons from one yard to four yards capacity.

Write for catalog showing complete line of Dump Wagons, Garbage and Asphalt Wagons.

Pioneer Excavating Outfits

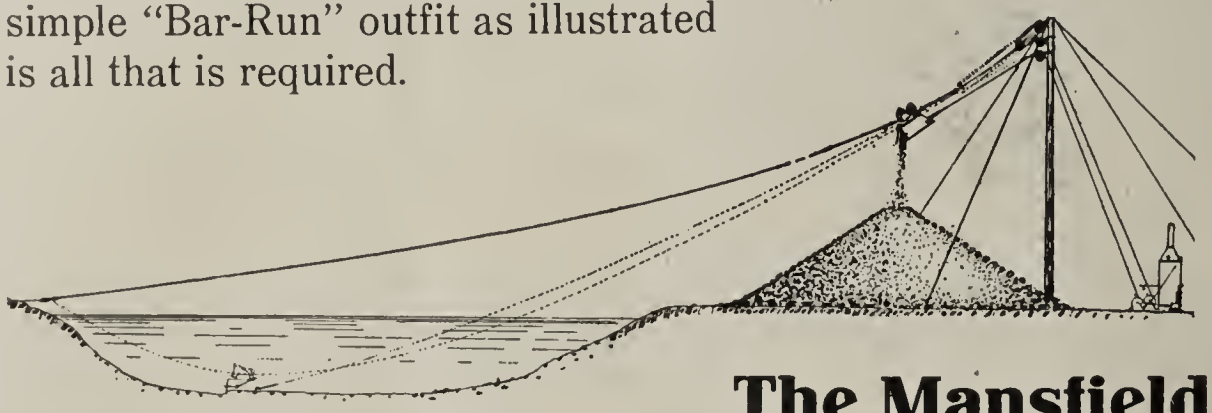
Are the Money-Makers that all live, up-to-date contractors are using for excavating their own gravel. Don't buy any gravel of a dealer until you investigate our plans and prices.

A regular one yard outfit for a 400′ span is as follows:

1-One yard PIONEER Back-Dump Bucket
400′-1⅛″ Track Cable
550′- ⅝″ Drag Cable
450′- ⅝″ Tension Cable
1000′-1 ″ Cable for six guys
2-14 ″ Single wire rope blocks
2-14 ″ Double wire rope blocks
15-1⅛″, 50-1″, 25-⅝″ Cable Clips
1-8¼″x10″ Double Drum Hoist Engine

The Pioneer Back Dump Bucket

Are used for either wet or dry excavation of gravel or any other material. No time or power lost in dumping, as it is instantaneous and automatic. For road gravel the simple "Bar-Run" outfit as illustrated is all that is required.



If it is worth a two-cent stamp to you; send for our Booklet No. 15, it will tell you all about it, and we will be glad to quote our prices on the above.

The Mansfield Engineering Co.
Indianapolis, Ind. **10th Floor Fletcher Bldg.**

SLAG from blast furnaces FOR CONCRETE

Blast-furnace slag used as an aggregate in concrete represents economy, safety and strength.

For many reasons, blast-furnace slag is an ideal concrete material—its alkaline nature tending to prevent rust in reinforced concrete—its light weight enabling it, in floor slabs for instance, to support a given live load with smaller dead load on supporting frame—its contents of silica, alumina and iron, which increases the permanency of any concrete of which it is a part—its fire-resisting qualities—these are some of the features which have impelled the most careful engineers and architects to specify slag in place of other concrete aggregates.

The high crushing strength of slag-concrete has been demonstrated in various tests made of unprejudiced parties in nearly every large city. Slag-concrete has always developed strength uniformly higher than gravel-concrete or limestone-concrete.

Engineers and Architects

Blast-furnace slag as a concrete material is better understood than it used to be. Before you write your concrete specifications, get in touch with any of the following competing producers of blast-furnace slag—let them submit the results of long-time tests of slag-concrete.

THE FRANCE SLAG CO.
Second National Bank Building
Toledo, Ohio

THE SOMMERFIELD CO., Inc.
1863 61st Street
Brooklyn, N. Y.

BIRMINGHAM SLAG CO.
1001 Woodward Bldg
Birmingham, Ala.

WESTERN DUMP CARS

Are Tried Cars

The name WESTERN on your cars means that your car worries will be reduced to a minimum, and that you have secured the highest quality in scientifically built dump cars.

WESTERN CARS Have Never Been Equalled

WESTERN WHEELED SCRAPER CO.

AURORA, ILLINOIS

SHEARER & MAYER DRAGLINE CABLEWAY EXCAVATOR

PATENTED)

Digging
Boulders and Gravel

Conveying and Elevating to Screening Plant

A simple, efficient, rapid and economical machine known for its wide area of operation and efficient excavation of material from either wet or dry pits. Digs, conveys a distance of 500 feet or more. Elevates and dumps the material into bin, screens, cars, wagons or storage piles.

Mr. Gravel Producer:

If, by the use of one machine you could eliminate a complicated excavating and conveying system at your gravel plant, would you not be interested? Then study the above cuts. Note the absence of men in and about the pit and figure the saving in labor cost alone, to say nothing of the saving of fuel and maintenance cost, made possible by a well designed, substantially constructed dragline cableway excavator.

ONE MACHINE—ONE OPERATION—ONE MAN CONTROL

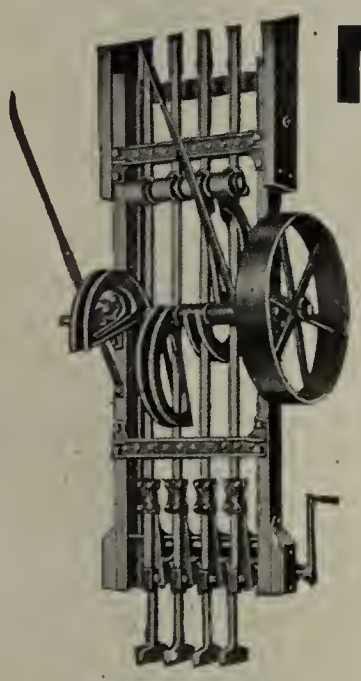
Write for Illustrated and Descriptive Booklet. **Information Furnished Free.**

Dumping Into Hopper Leading to Crusher and Screens

SAUERMAN BROS., 1139 Monadnock Blk., Chicago

They Pay for Themselves in Fifteen Working Days—

Miller's Power Tamper or Miller's Block Machine

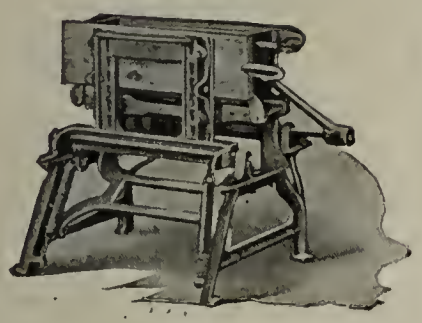


There is a big demand for Miller's concrete blocks, because they have clean, clear cut face designs; because every block is of exact proportions, and because they meet the requirements of a high class building unit at a price that is within the reach of every builder.

You Can Turn Out High Class Products at Low Cost

with Miller Power Tampers or Miller Block Machines. That is why Miller Concrete Product Factories are so successful.

A Miller Tamper in your plant means the manufacture of a better, more uniform block with less labor and a larger output—a block that will sell for a higher price than the products of your competitors. Can fit any block machine.

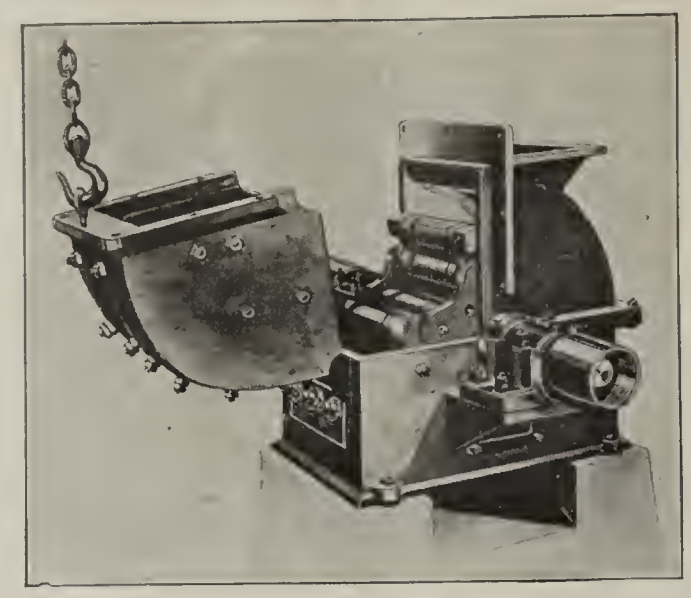


MILLER'S "BLOCK KING" makes the best block in shortest time at lowest cost. Unlimited range, sizes and shapes.

SHIPPED ON TRIAL ANYWHERE. Don't order until you get our catalog. Write today.

J. C. MILLER COMPANY

114 W. Clark Street **JACKSON, MICH.**



The Brainard Made in Four Sizes

A crusher as well as a pulverizer. Easily accessible and works upon the IMPACT principal, while the material is in suspension, requiring no adjustment to maintain capacity or size of product.

Number or size	Largest size feed	Capacity tons per hour	H. P. required	Approx. weight
0	4 x 4"	2 to 8	6 to 8	1600
1	4 x 8"	3 to 15	10 to 12	2600
2	6 x 12"	8 to 35	20 to 22	5800
3	10 x 20"	20 to 100	40 to 50	17000

Also a full line of Brainard Universal Jaw Crushers, Elevators, Screens, and power transmission equipment.

Send for Catalogue Matter

Mechanical, Metallurgical and Mining Engineering. Special attention given to the design and erection of metallurgical plants of all kinds, also cement and crushing plants and quartz mills.

MIDLAND CRUSHER PULVERIZER CO.

37 W. Van Buren St., Chicago, Ill.

NORTHWESTERN PORTLAND CEMENT

A RELIABLE PORTLAND CEMENT

NORTHWESTERN STATES PORTLAND CEMENT CO. NORTH WESTERN PORTLAND CEMENT MASON CITY, IA. REGISTERED TRADE MARK

A PORTLAND CEMENT FOR THE

NORTHWEST

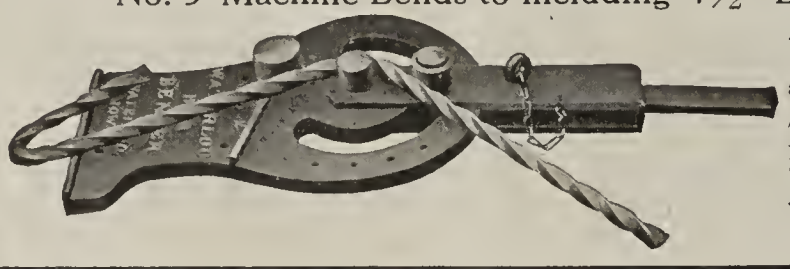
"Concrete for Permanence"

Northwestern States Portland Cement Co.

MASON CITY, IOWA

The Waterloo Bar Bender will pay for itself on the first job

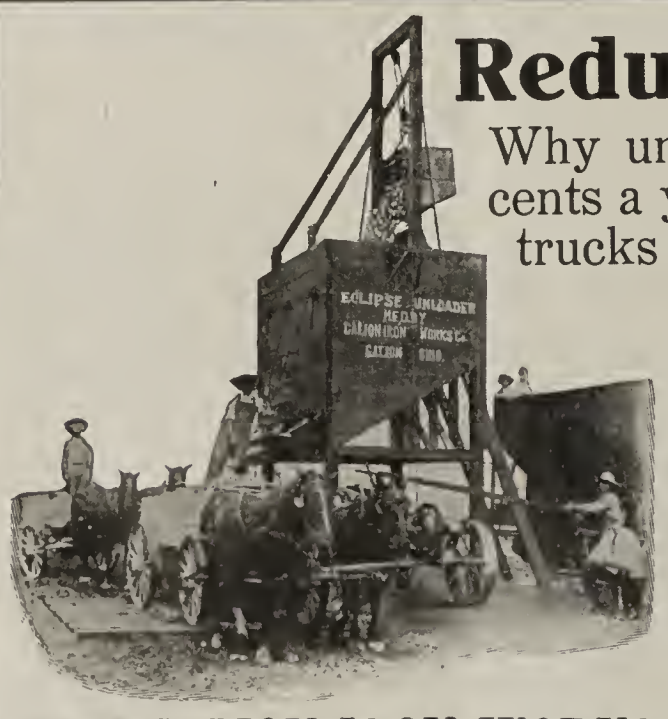
No. 2 Machine Bends to including 1⅛" Bars, weighs 110 lbs. Price - - $18.00
No. 3 Machine Bends to including 1½" Bars, weighs 210 lbs. Price - - - 23.00
Machine Stand weighs 90 lbs. Price - 10.00



The price of this bender is returned to you in time and money saved on your first job, and the machine itself is indestructible, so you multiply this saving year by year.

Makes bends at various angles to meet any design. Bending posts of turned steel. The post that revolves through the slot in the plate is equipped with loose steel roller to keep bar from creeping during bending. Machine is furnished with detachable handle 7 ft. long. No. 2 machine is especially adapted for field work.

Waterloo Construction Co., - - Waterloo, Iowa



Reduce Cost of Unloading Cars

Why unload material by hand at a cost of 15 cents to 20 cents a yard? When you can unload material from cars to trucks with an Eclipse unloader at a cost of 2 cents a yard.

The Eclipse Portable Unloader

does this by unloading your crushed stone, gravel, sand, slag, coal, etc., from hopper bottom cars to wagons at the rate of 10 cars per 10 hour day.

Your wagons or trucks are loaded in ½ minute instead of ½ hour—by one man instead of 10 or more shovelers. No delays, no waiting for loads—your drivers and hauling equipment are kept busy all the time.

The Eclipse Portable Stone Unloader

is saving contractors thousands of dollars annually. Go over your cost records and figure how much money an unloading cost of 2c a yard would save you—then write for all the facts to

THE GALION IRON WORKS & MFG. CO., 124 East Main Street, GALION, OHIO

Everything in CUT GEARS

We have the largest and most modern equipped gear making plant in the west. Our gear making machinery embraces everything known that will in any way facilitate the manufacture of high-grade cut gears of all kinds up to 15 feet in diameter.

Quick Deliveries, Low Prices and First Class Work Our Motto

Foote Bros. Gear & M. Co.

210 to 220 N. Carpenter St., Chicago

IMMEDIATE DELIVERY

"Franklin"

ROUND—SQUARE—FLAT—SQUARE TWISTED

STEEL BARS
for CONCRETE REINFORCEING

We can meet your Reinforcing Steel Requirements. This means not only quick shipment from the mills but co-operative service for rapid transportation. If you want to know just what your exact cost will be, send us the Blue Prints and we will give you a lump sum bid on all the steel sheared to lengths, bent to specifications and delivered to the job,

Our Engineering Department is at your service.

The FRANKLIN STEEL WORKS
FRANKLIN, PENNA.

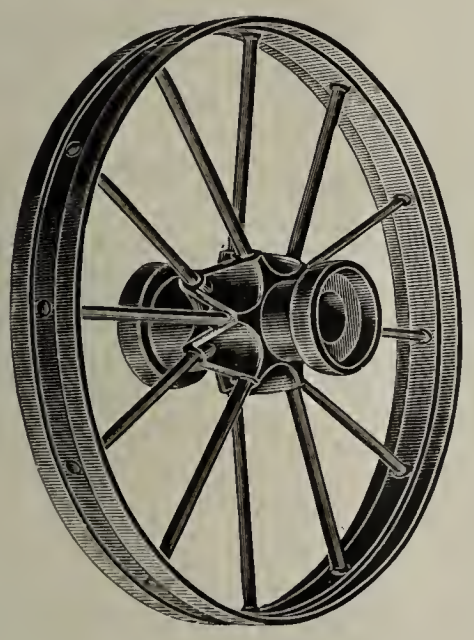
Cleveland, 1320 Rockefeller Bldg.
Boston, - - 12 Pearl Street
Philadelphia. 2215 Race Street
New York, - 30 Church Street
Chicago, - - 332 So. Michigan Blvd.
Buffallo, - Erie County Bank Bldg.
Pittsburgh, Oliver Bldg.

QUALITY SERVICE

EMPIRE STEEL WHEELS
and Steel and Wood Trucks

for concrete mixers, pumps, air compressors, gas engines, stone crushers, quarry drills, etc.

Empire Steel Wheels Are With Plain or Grooved Tire



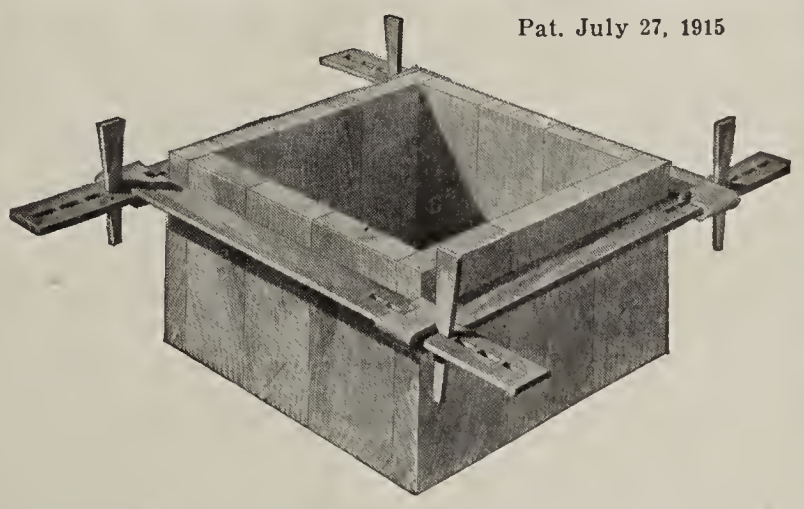
Empire Steel Wheels Any Hub Size to Carry Any Weight

We make a complete line of Trucks, both steel and wood—axles and parts for Concrete Mixers, Trucks and other mountings. Send specifications of what you use and get our proposition.

EMPIRE SERVICE is Prompt Deliveries.

Address
EMPIRE MANUFACTURING CO.
27 Cedar Street QUINCY, ILL.

Pat. July 27, 1915



Let us prove
You can save money on column form work

Send us a small trial order for K & W Clamps—use them on your next job, and you will see what a big money saver they are.

K & W Clamps tighten the columns, *using only a hammer. Speed up form work.* No bolts and 2 x 4's to eat up carpenters' time—as well as material wasted. K & W Clamps last until you lose them.

K & W Perfection Column Clamps

Can be used on any size column, square, rectangular or octagonal. *Perfect adjustment every time*—any variation in lumber thickness is taken up by the key-and-slot arrangement. And K & W Clamps have *no "dead space."*

Stock sizes, ready for immediate shipment:
12 in. to 26 in. column adjustment.
18 in. to 32 in. column adjustment.

Order a few and *test the saving yourself.*

The K & W Clamp Co.
Builders' Exchange Minneapolis, Minn.
Geo. B. Carpenter Co., Chicago

Hardest
and
Most Durable

GRANITE

Crushed to proper sizes for all kinds of paving and construction work.

Our granite insures strength and lasting qualities and is a distinct economy.

Large Stocks—Prompt Deliveries

Granite Screenings — clean and sharp—for concrete work.

BADGER CRUSHED GRANITE CO.
179 W. Washington St. CHICAGO

Granite Facing
in Sheets

The only part of the facing material that you put into a block machine that shows on the block is *the surface itself*. To make a granite block you have only to provide for *granite surface*. Why make your facing seven or eight times as thick as you need it? You are multiplying the cost of your facing material seven or eight times when you do that.

We coat a sheet of paper (for any size of block) with crushed granite. Place the sheet, paper side down, on the face plate, tamp in the wet backing and when the block has set, remove the paper by applying warm water. You will have a granite-face block rivaling natural stone in appearance. You reduce the cost of facing material and the cost of applying it and your block requires no finishing as there is no cement film on the face to be etched off.

Concrete Block

Graniting Machine $18.00

Manufacturers owning their own machine can manufacture this sheet facing in their own plant at less than ¼c per sheet, as one ton of granite costing $3.25 at Crown Point, N. Y., will face 4,500 sheets of 8x16 facing by using our process.

Cloth sheets are used for lining forms for slush work, caps, lintels, dimension stone, stucco or pebble dashing, floors, walls, etc., and full directions for making this granite cloth will be sent with every machine sold.

Write for circular describing this method of making a high-class block at low cost. Sample sheets and prices will be sent promptly.

B. F. GIBLER, Mauston, Wis.

For Facing Concrete Work

No other material can quite compare with Middlebury Terrazo. It is furnished carefully graded to size—in either dust, No. 1, 2 or 3.

It is made from Middlebury White and Creme Statuary Marbles; and when used for facing stucco work gives an appearance equal to that of solid marble, and with all the advantages of marble, at a material saving in price.

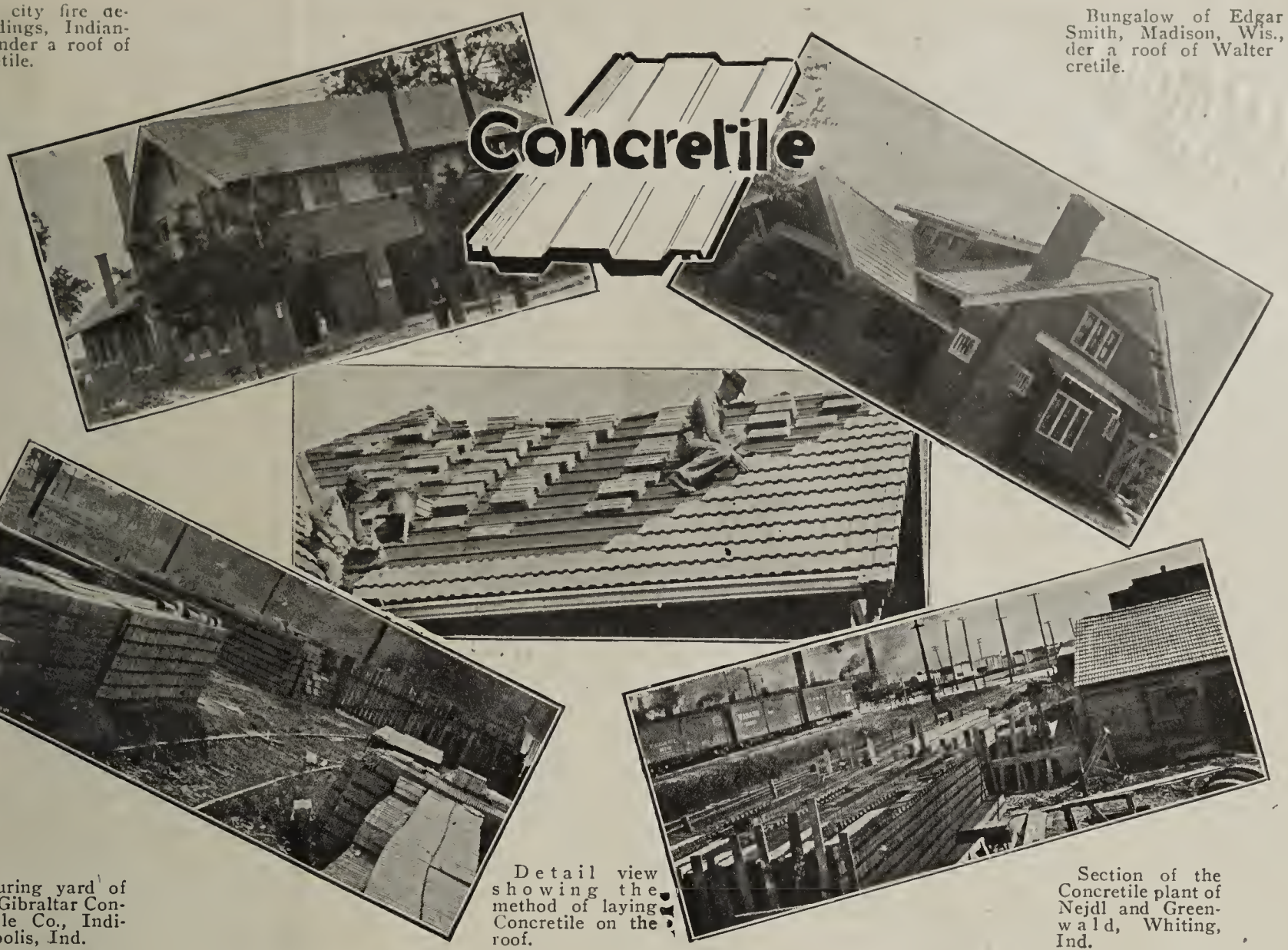
Send for samples and prices.

Middlebury Marble Company

Brandon, Vermont

One of the city fire department buildings, Indianapolis, Ind., under a roof of Walter Concretile.

Bungalow of Edgar W Smith, Madison, Wis., under a roof of Walter Concretile.



Curing yard of the Gibraltar Concretile Co., Indianapolis, Ind.

Detail view showing the method of laying Concretile on the roof.

Section of the Concretile plant of Nejdl and Greenwald, Whiting, Ind.

Start a "Concretile" Plant

An opportunity for business builders

There is a market in every county for Walter Concretile. The establishment of a plant requires a small investment. The opportunity awaits the man who has the ability to manufacture and market a worthy product that finds ready sale.

Walter Concretile has been manufactured and used for years in Europe. The product is not new. Its manufacture is an operation that is simple for any man. The equipment required is not expensive.

From reports received from plants now in operation, the average cost of manufacturing tile for 100 square feet of roof is $2.50. The product competes in quality and beauty with the best clay tile, and you can see how it would compete in price. The plants now manufacturing Concretile are making money.

What "Concretile" users say:—

"The Concretile roof on the new Fire Engine House is satisfactory in every way. I believe this material to be the very best fireproof material that is made today, and would advise its use on any kind of a building, as nearly 80 per cent of our fires occur from sparks on dry shingle roofs."

J. Harry Johnson,
Chief Indianapolis Fire Department.

De Kalb, Ill., July 26, 1916.

Dear Sir:—Your letter received a day or two ago, and in answer to same wish to say that we are very well pleased with the roof we have of the Walter Concretile. I believe it is one of the best roofs that can be put on. The tile does not crack or leak, as my roof has been on about five years. Yours truly,

O. W. Johnson.

Marengo, Ill., July 26, 1916.

Dear Sir:—In regard to your question of the cement shingles, will say that they make a fine roof. Mine has been on about five years and are as good as the day they were put on. Never had a leak nor a crack. Will recommend it as a good durable roof. Yours truly,

S. K. Grimes.

"We own ten Walter Concretile machines now and have made as high as 45 tile per hour on one machine. The machines average 30 per hour. We find that Concretile roofs advertise the product sufficiently and repeat orders are coming in rapidly. Your statements regarding the profits in this business have proved very conversative."

Gibraltar Concretile Co.,
Indianapolis, Ind.

We sell you complete equipment for starting the business. You can add to your equipment as your business grows. We don't sell territory, but we establish only one plant in a locality. We help you get started. We make sure that you turn out a first-class product and we help you create a market for it.

Send today for our booklet on the manufacture of Walter Concretile.

Walter Concrete Machinery Co.
418 Saks Bldg.,
INDIANAPOLIS, IND.

TRADE MARK

What "Concretile" manufacturers say:—

HAWTHORNE CEMENT PRODUCTS CO., CICERO, ILL.
4600-34 W. 26th Street

Walter Concretile Machine Co. Sept. 16, 1916.
418 Saks Building, Indianapolis, Ind.

Gentlemen:—In your letter of the 6th inst. you inquire as to my success in the second year of our manufacture of Walter Concretile. I am running my six machines full time and continually keeping 1000 squares of tile on hand. At present I have orders for 16 porches, 2½ squares each; 3 bungalows, 23 squares each; and one big residence in Highland Park, of 45 squares. We expect to install at least two more machines in the spring. So far I have not had a complaint as to leaks, in any of the roofs I have laid. My six machines still average 475 tile a day, per machine, with a cost of $2.21 per square to produce. I can see a great future in our district, as it is taking far better hold than I expected. Thanking you for your interest in our success, we are,

Very truly yours,
Hawthorne Cement Products Co.,
By A. O. Tamm, Mgr.

Spremberg, N. L., Germany.

Mr. Otto Walter, Indianapolis, Ind., U. S. A.

Dear Sir:—After having used your cement Roofing tile for more than twenty years I feel obliged to write you my acknowledgment of the worthiness of your goods.

The material received from you has during the time not only given good wear, but has proven itself superior to any other roofing material.

I have used this tile not only on my own dwelling but also in the city and vicinity, and have nothing but praise for same. I not only recommend it to my friends, but also to every citizen everywhere. Very truly yours.

Wilhelm Handrick,
Contractor.

HYDRATED LIME

Will improve the quality of Concrete Blocks at practically no increase in cost—here is how it is done—

Hydrated lime insures a uniform mixture because it makes a good, sticky mortar which adheres to each piece of the coarser aggregate.

Concrete is more easily tamped when it contains hydrated lime, consequently resulting in a more dense product.

Hydrated lime retains a greater amount of water long enough to aid further hydration of the cement. The strength of a concrete product is dependent upon the amount of cement which becomes hydrated after leaving the forms.

Concrete products containing hydrated lime take sharper impressions from face plates, and leave the finished products uniformly light in color.

Hydrated lime renders concrete products impermeable even under pressure.

Small percentages of hydrate are being used by a large number of concrete products manufacturers with these results.

About ten pounds of hydrated lime to each bag of cement used is the correct proportion.

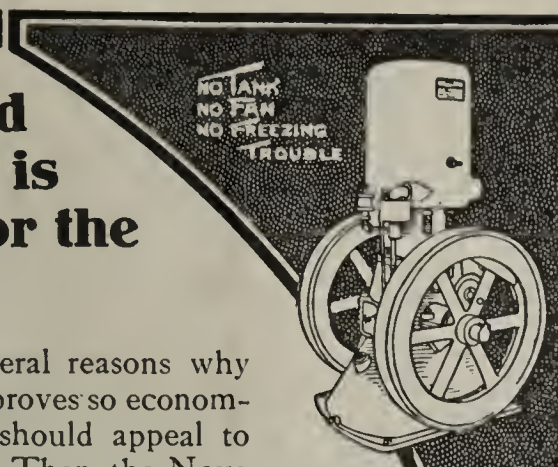
Add it to the mixture and mix in the usual manner.

Concrete Stand Pipe at right, it is 78 feet high, 30 feet in diameter inside, 20 inches at base and 12 inches at top. The mixture is one of cement, one and one-half of sand. three crushed stone passing one inch ring, and 5% hydrated lime for waterproofing, It is reinforced by plain round rods. Built at the Massachusetts State Farm, Mass.

Write any of the following competing manufacturers of Hydrated Lime for complete information about Hydrated Lime in Concrete, also for their booklet on the use of Hydrated Lime in Concrete Roads.

Saginaw Lime & Lumber Co., Saginaw, Alabama.
Marblehead Lime Co., Chicago, Ill.
Port Byron Lime Assn., Port Byron, Ill.
Ohio & Western Lime Co., Huntington, Ind.
Solvay Process Co., Moline, Kans.
Security Cement & Lime Co., Hagerstown, Md.
Tidewater Portland Cement Co., Baltimore, Md.
Lee Lime Co., Lee, Mass.
White Marble Lime Co., Manistique, Mich.
Marblehead Lime Co. Kansas City, Mo.
Ste. Genevieve Lime Co., St. Louis, Mo.
Dutchess County Lime Co., Dover Plains, N. Y.
The A. & C. Lime Co., Canton, Ohio.
Kelley Island Lime & Transport Co., Cleveland, Ohio.
National Lime & Stone Co., Carey, Ohio.
John D. Owens & Son Co., Owens, Ohio.
Woodville Lime & Cement Co., Toledo, Ohio.
Gager Lime & Mfg. Co., Chattanooga, Tenn.
Dittlinger Lime Co., New Braunfels, Tex.
Vermont Marble Co., Proctor, Vermont
Riverton Lime Co., Riverton, Va.

No Skilled Engineer is Needed for the Novo



This is one of several reasons why the Novo Engine proves so economical and why it should appeal to every contractor. Then the Novo is so light—the lightest engine for power developed—that a lot of time is saved in moving your mixing outfit. Time lost soon runs into money.

NOVO ENGINE

"The Engine for Every Purpose"

The absence of lateral vibration adapts the Novo particularly to the running of cement machinery. Ten sizes, 1 to 15 h. p.

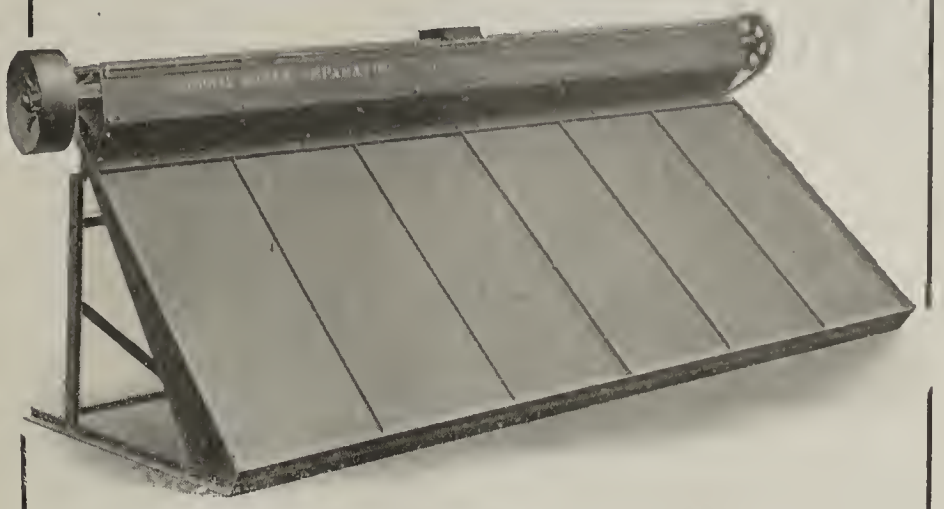
Send for Novo Catalog

and look into this question of power. It is worth careful consideration.

Novo Engine Co. Clarence E. Bement, Sec'y and General Manager

219 Willow Street - - Lansing, Mich.

National Screen Separator



No. 5. National Screen Separator 12 ft. wide.

Gives Positive Results and Greatest Efficiency

Built in four sizes, 4, 6, 8 and 12 ft. wide.

Other special features to consider are as follows:

Simplest and most substantial construction.
Economical operation.
No mechanism on lid or cover.
Can examine the separator while in operation.
Abundant references from the largest concerns.

Write for catalog and prices

NATIONAL ENGINEERING CO.

5 N. La Salle Street CHICAGO

Fuller Face Hardened Sprocket and Traction Wheels

Unequaled for severe duty. Proven by test. Their use prolongs the life of chain.

RESULTS:—Increased Efficiency—Saving in Operating Cost.

We manufacture all kinds of wearing parts subjected to abrasion.

Write for Fuller Quality Products Catalog No. 50—C

LEHIGH CAR, WHEEL & AXLE WORKS, :: CATASAUQUA, PENN.

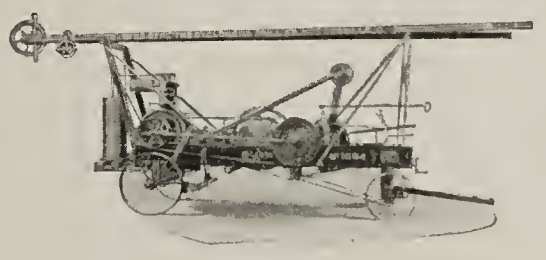
NEW YORK, N. Y., 50 Church St. PITTSBURGH, PA., Farmers Bank Bldg. CHICAGO, ILL., McCormick Bldg.

A Big Blast-Hole Drill That's Reliable

—THE CYCLONE No. 14—

Heavy, solidly braced frame—Sill timbers 4" x 14". All machinery placed directly on the main sills protecting it against strains and preventing top heaviness. **Eighty per cent (80%) of the castings are cast steel**—not cast iron. The Cyclone No. 14 is the only Blast-Hole drill so built.

Furnished in Steam, Gasoline, Compressed Air or Electric Power; traction or non-traction.



THE SANDERSON-CYCLONE DRILL CO., ORRVILLE, OHIO

Eastern and Export Office, 50 Church St., New York, N. Y.

The Aero Pulverized Coal System

is a **Unit System.** The Pulverizer and the furnace is the unit. There is nothing between them but a plain iron pipe. Coal drying is optional.

The AERO is a no-storage system and therefore free from fire and explosion hazards.

The pulverizing, mixing and feeding operation, as well as the furnace, are at one time under the eye of one man. Write for Bulletin.

AERO PULVERIZER CO., 120 Broadway, NEW YORK

FOR SALE AT A BARGAIN.

30 H. P. American Hoist; 600 ft. 1⅛" cable; 800 ft. 1-inch drag line cable; ¾ cu. yd. Negley excavator bucket: 40 ft. elevator with complete 2,800 ft. ¾-inch rope cable; 20 ft. screen 3 ft. dia. Address R. S. Jennings, New London, Wis.

FOR SALE.

One 30-inch Iron Frame Single Roll Griffin Mill; very little used. Will sell for half price of new mill. Address Mill, P. O. Box 286, Newark, N. J.

SITUATION WANTED.

As Chemist or Asst. Chemist with cement company needing man at once. Graduate chemist—thoroughly experienced. Address B., care Cement and Engineering News, 672 Transportation Bldg., Chicago.

POSITION WANTED.

Superintendent or Asst. Supt. position at a Portland coment plant wanted by Mechanical Engineer, graduate, wishing to change from constructive to administrative part of the cement business. Is a first class man with six years experience designing and erecting portland cement plants. Address A. N., care Cement and Eng. News, 672 Transportation Bldg., Chicago.

WANTED.

A cement chemist and cement expert, having six years' experience as chief chemist, desires a position with a cement company. Address C. C. care Cement and Engineering News, 672 Transportation Bldg., Chicago.

Special Bargains

Hayward ¾ yd. standard Orange Peel.....	$ 375
Browning 1 yd. Clam Shell Bucket.....	290
Page 1 yd. Drag Line Bucket.....	350
Page 1 yd. Drag Line Bucket (Light).....	300
Industrial 1½ yd. Clam Shell Bucket.....	375
Lidgerwood 6¼x10 D. C. D. D. with Boiler	590
Flory 7x10 D. C. D. D. with boiler.....	625
Lidgerwood 8¼x10 D. C. D. D. with Boiler	725
Parsons Model "K" Trencher, 27" to 10'..	3,500
Thew No. 0 Traction Shovel, A-1 condition	2,350
Thew No. 0 Shovel, standard gauge.....	2,250
Bucyrus 2½ yd. 65-ton Steam Shovel.....	3,250
Shay Geared Loco, 6x10 for 24" gauge....	1,000
Porter 9x14 Dinkey 36" gauge, overhauled..	885
10 Roger 40-ton Ballast Cars; rebuilt, @..	475
20 Western 12 yd. 19' Dump Cars, @.....	425
30 Western 4 yd. Dump Cars, 36" ga., @..	100
20 Western 1½ yd. 24" ga. Dump Cars, @	38
Smith 1/3 yd. Mixer, E. & B. on truck....	325
Foote 1 bag Paver; steamer, traction.....	650
National 10x18 Jaw Crusher, mounted....	375

Get my prices on Concrete Buckets, Steam Rollers, Air Compressors, Pumps, Rail, Pipe, Steel Piling, Locomotive Cranes, Etc.

WILLIS SHAW

RailwayExchangeBldg.,CHICAGO

"Impervite" Waterproofing Receives Gold Medal

After TESTING Impervite and all other waterproofing compounds exhibited, the Judges at the San Francisco Exposition have just given Impervite the HIGHEST AWARD—the only compound so honored.

A ¾-inch inside facing of Impervite mortar will waterproof any leaky cellar or pit.

Satisfaction guaranteed or money refunded.

The Standard Paint Co.

572 Woolworth Bldg., New York
Peoples Gas Building, Chicago
Beacon Building, Boston

FOR SALE

Sand and Gravel Plant

fully equipped for economic production. Centrally located, on Missouri River and two railroad systems. Good town and good shipping territory. Inexhaustible supply of sand and gravel. Has made money for years, and good management should double business first year. Plant is in fine condition. New buildings. Can be bought for less than invoice. Price $36,500.00, $5,000 cash, balance in payments, covering a 10 year period. The business should pay for itself within 4 or 5 years. Have highly recommended railroad contractor with years of experience both as a sand and gravel user and as a producer, who would like to go in with the right man. He wants one-third interest, so will sell all or two-thirds interest. It is a safe and staple money-maker.

For particulars address.

W. W. G. HELM, Boonville, Mo.

Wanted

The following second-hand equipment:

1 No. 6 Gyratory Crusher, or
1 Blake type crusher, capacity 400 tons in 12 hours to 1½".
1 48"x10' trommel, ½" opening wire jacket.
1 Pair 48"x16" heavy duty rolls.
1 60"x40' ore dryer.
2 Type H°H Newaygo Screens.
1 Pair 30"x14" Heavy Duty Rolls.
2 Pair 24"x14" Heavy Duty Rolls.
1 Shaking chute feeder.
1 Rotary Concentrate dryer, 48"x20'.
2 48"x60" Shaking screens with 100 mesh wire cloth to be used for dewatering concentrate.

The following flour mill machinery which is used for refining flake graphite:

4 Horizontal type burr mills, size 36", or 42", or 48".
4 Flour dressing reels with No. 4, No. 6, No. 8, and No. 12 cloth, respectively.
2 Reels same as above with No. 14 cloth.

Motor Equipment.

1 Belted hoist, capacity 5 tons, 250 ft. per minute. 40° incline. To be driven from crusher motor, line shaft.
3 50HP, 440V, 3P, 60CY, Squirrel Cage Motors, complete with slide rails and starters, and pulleys.
2 75 Horse Power Squirrel Cage Motors, 440V, 3P, 60CY, complete with slide rails, pulleys and starters.

(Address) Theodore Fisher,
134 East Perric St.,
Decatur, Illinois.

In making price give full particulars as to the condition of the machinery offered. All machinery must be in good first-class serviceable condition.

Standard DETROIT USA

Heavy Service Trucks

Made in 2, 3½, 4 and 5 Ton Sizes

Standard DETROIT USA

—Are always on the Job!

Stands up under severe, continuous usage with smallest cost of up-keep!

The Illustration Shows

A Standard Truck in Minneapolis, which has been successfully hauling great loads of cement, gravel and crushed rock over the extreme grades of that city. This "battle-scarred" truck is still on the job—just another proof that Standard Trucks will work day and night continuously for months and require the least repairs.

There are no impractical, unreliable motor trucks with the name **"Standard"** on them! There are no standard trucks without the name **"Standard"** on them!! Before you buy, let us send you the names of Standard Truck owners—you'll be making sure of satisfactorily long service beforehand.

"Standard" Trucks are composed entirely of standard parts throughout—such as Continental Motors (with automatic governor) Brown-Lipe transmission, Timken axles, Gemmer steering gears, Timken bearings, Stromberg carburetor, Eisemann magneto, etc.

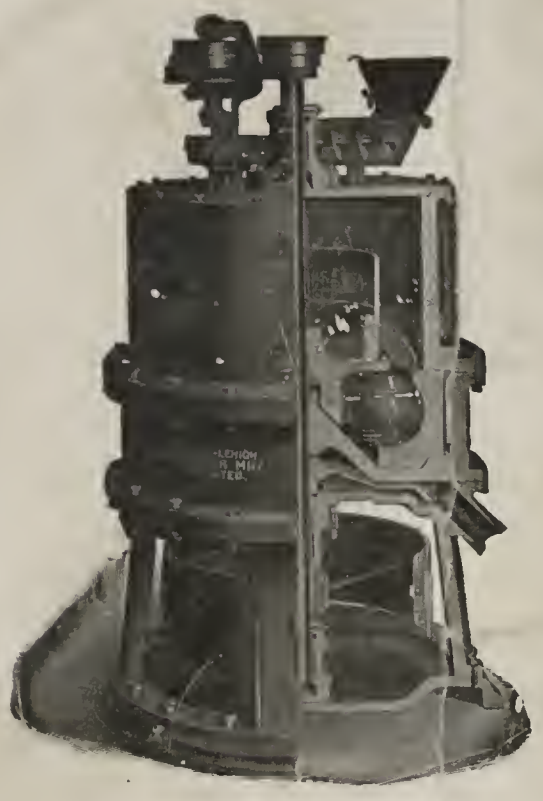
Never before has such a combination of highest grade improvements, standardized construction, power and capacity been offered in 2, 3½, 4 and 5-ton chain or worm-drive trucks at such remarkably low price. Write us for Bulletin 43.

Standard Motor Truck Company

Detroit, Michigan

Records prove that "Standard" Trucks will work continuously day and night for months without one dollar's worth of repairs!

THE FULLER-LEHIGH Pulverizer Mill
PRODUCES COMMERCIALLY



Cement having a higher percentage of Impalpable Powder than can be obtained by any other mill.

Tests show that the tensile strength of a 1-5 mortar made with cement pulverized by the Fuller Mill is higher than the tensile strength of a 1-3 mortar made with cement pulverized to the fineness required by the Standard Specifications.

Cement companies equipped with Fuller Mills advertise the fact that the consumer gets 38 pounds more of the IMPALPABLE POWDER or REAL CEMENT in every barrel of cement produced by the Fuller Mill than by any other.

LEHIGH CAR WHEEL AND AXLE WORKS

NEW YORK, N. Y.
50 Church St.

Main Office: CATASAUQUA, PA.
PITTSBURGH, PA., Farmers Bank Bldg.

CHICAGO, ILL.
McCormick Bldg.

The Best and Most Innocent Are Often Wrongfully Accused

For instance, take a case where a belt was allowed to run slack enough to slip, causing "pulley burn." There was no actual evidence that this had happened after the one responsible tightened her up—his "boss" was a man who knew nothing of belts and was easily convinced that the concern who sold the belting "put one over."

Schieren's Duxbak Waterproof Leather Belting is less liable to pulley burn because it keeps a uniform length in all kinds of weather after once being properly fitted to the pulleys.

Try one of these non-stretch belts and you'll find it costs far less in the end than ordinary kinds

DUXBAK BELTING
TRADE MARK
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